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TIME IN ENGLISH VERSE RHYTHM

AN EMPIRICAL STUDY OF TYPICAL VERSES BY THE GRAPHIC METHOD

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BY

WARNER BROWN, A.M.

Submitted in Partial Fulfilment of the Requirements for the Degree of Doctor of Philosophy, in the Faculty of Philosophy, Columbia University

Reprinted from the Archives of Psychology, No. 10

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TIME IN ENGLISH VERSE RHYTHM

This study treats of the time relations found in English verse rhythm. It states the defects of the current methods of studying the subject and the advantages of psychological experimentation by the aid of graphic records of the voice. Selected examples of English verse are then examined and the various theories of metrists and psychologists on the subject criticized in the light of the experimental results.

INTRODUCTION

No one will contradict the statement that all verse is characterized by rhythm. About poetry there may be some dispute; at any rate highly poetic prose may not be particularly rhythmical and may at the same time be better poetry than some very regular verse. Every theory of rhythm, no matter what its other peculiarities, must be sufficiently broad to include verse. Music and verse are the sources of most of our more affective experiences of rhythm. Not that there are not many other rhythmical experiences in our daily life, indeed the ordinary functions of our organic existence are constantly supplying a stream of sensations which are at once recognized as rhythmical when attention is paid to them. But it is through our ears that we are best able to enjoy perceiving rhythms and with the voice that we produce them oftenest and with the greatest satisfaction. The ordinary organic rhythms go on unperceived for the most part, and the same may be said of such semi-voluntary movements as walking or riding a bicycle. Even heard rhythms are frequently ignored, it is true, but music and still more verse receive a high degree of attention. And even if we learn to disregard music under certain circumstances, when we are occupied in conversation or otherwise preoccupied, the sound of recited verse retains its power to compel our attention.

This is perhaps due to the infrequency with which recited verse is heard under modern conditions; the ancients perhaps paid as little attention to the public reciter as the modern gourmet pays to the orchestra while he dines. However this may be with regard to passive appreciation, it is certain that the act of producing or reproducing music or verse—still better good music or poetry—is keenly enjoyed by most people.

The mere admission, however, that all verse is rhythmical tells very little about the nature of rhythm itself and still less about verse. It is here that all the confusion arises, for without an adequate determination of one or the other term no advance can be made. If rhythm could be defined once for all it would be feasible to apply this definition to verse. On the other hand if verse were once fully analyzed a definition of rhythm could be indirectly derived with some degree of assurance.

In view of the difficulty of defining rhythm independently the other course seems the more hopeful. The task appears simple, and once accomplished there could be no more of the "inaccuracy, confusion, misconception, misrepresentation, mystification, and downright ignorance" of which Poe complains so bitterly in that essay of his which is still the most penetrating analysis we have of English verse.[1] Yet simple as the task seems it has not been accomplished and indeed has scarcely been broached by a long line of students both metrists and psychologists.[2]

That the net result of all the careful attention devoted to the subject of verse rhythm has been so inconclusive is due in great measure to one fundamental mistake in method—a mistake which has not been recognized till recently, and which is being corrected only slowly. This mistake lies in treating rhythm objectively as an art form rather than as a form of motor expression. By this I do not mean to express a prejudice against all but the so-called "motor theories" of rhythm. And indeed I would by no means slight the study of rhythmic forms as they are perceived. But I do maintain that the study of verse forms would have gotten along much faster, if we had paid more attention to the actual performance of an individual in producing spoken verse, and less to the impression made upon a listener. After all it is the nature of the rhythmic action which counts.

So long as the listener receives a rhythmic impression it is enough. Beyond that his analysis is at best unscientific and at worst positively misleading. He is open to all sorts of peculiar illusions arising from the nature of the material in hand. It is a well known fact that the estimation of intervals of time is extremely difficult under the best of circumstances. It is peculiarly

[1] Poe, E. A., "The Rationale of Verse."

[2] For a bibliography of metrists see Gayley and Scott, "An Introduction to the Methods and Materials of Literary Criticism," Chap. 7, 1899; Omond, T. S., "English Metrists," 1903. For psychologists see Wallin, J. E. W., *Studies from the Yale Psychol. Laboratory*, **9**, 1901; Stetson, R. H., *Psychol. Rev. Mon. Sup.*, Vol. IV., p. 413, 1903; Triplett and Sanford, *Am. Jour. of Psych.*, **12**, 1901; Miner, J. B., *Psychol. Rev. Mon. Sup.*, No. 21, 1903; Minor, J., "Neuhochdeutsch Metrik," 1894.

hard to equate intervals filled with different sensational content—lights and sounds, or sounds of different intensity or quality. But in verse or poetry the conditions are still more difficult, for not only are the intervals to be compared filled with a content which is constantly changing in sensational quality—the endless variety of sounds which make up the words and phrases—but it is also disturbed by the intellectual and emotional content. Verse can not be heard as a mere succession of sounds making up a rhythm. It also conveys ideas and has meaning. And the meaning of it can not fail to interfere with any attempt to form an estimate of the duration or intensity of the mere sounds.

A comparison of the various ideas which various individuals have held will suffice to justify this indictment of conclusions reached by the unaided ear in the analysis of the sounds of verse. And even the most superficial study of the verses which I have analyzed will convince anyone that the time values of words in our verse are far different from what he himself would be led by his ear to expect. Illusions due to the variety of sensational quality of the sounds themselves and graver illusions arising from the fact that verse must have meaning to be verse at all can only be avoided by putting a mechanism in place of the impressionable listener to analyze the sounds. Such mechanisms are available. They are designed to present in the form of a curve or otherwise the actual sounds produced in speaking. Such a record is of course one-sided in that it deliberately excludes all the sense content of speech.

But such a one-sided treatment is what scientific procedure demands. To study a phenomenon in its entirety may occasionally yield good results but as a rule analysis must proceed first by exclusion. The problem must be made specific before it can fairly be attacked. Speech or verse rhythms in their true character present a multiplicity of difficulties like the proverbial bundle of arrows. To reduce them all at once is a task far beyond the power of the present writer; this enquiry, therefore, is concerned only with the sounds which reach the ear as one listens to verse which is spoken. No account can be taken, then, of all the wealth of feeling and idea which such sounds express and convey. No matter how much we may regret such a forcible divorce of the sense from the matter no other course is open. Doubtless such a separation may seem to some readers useless as well as arbitrary. And so far as the arts of versification and poetry are concerned it is useless. Poets will continue to write good or bad verse according to their gifts as heretofore; no formulæ can tell them how to practise their art nor even serve as criteria of success or failure for them.

But for the psychologist such an arbitrary analysis as I propose

is by no means useless. Rhythm is one of the commonest psychological phenomena. Hardly an act is performed by us either mentally or physically into which rhythm does not enter as one of the obvious factors. Yet we know little of the nature of rhythm. In fact we can scarcely define it coherently. There seems to be about it an element of regularity and a recurrence in time; but wherein the regularity consists we can not definitely say nor can we specify what the conditions are under which recurrence in time takes on the additional characteristics of a rhythm. In verse, however, we have rhythm exemplified—about this there can be no doubt—and there is every indication that an analysis of verse will reveal certain of the essential characteristics of all rhythm. And even if such positive characteristics do not appear the analysis will serve to exclude from further consideration certain features generally attributed to rhythmic phenomena but which are not found in the actual analysis. For in this case as in many others negative results are of positive value. The beginning of definition is in elimination and there are abundant indications that the definition of rhythm will profit by eliminating some of the qualifications—particularly in regard to regularity of recurrence—which have attached themselves to it.

The fact that careful analysis of verse—admittedly one of the earliest and commonest forms of rhythmic expression—does not reveal certain features claimed to be essential to rhythm will prove that they are not essential. It is thus that the psychologist is justified in mutilating good verse in order, not so much to find out how it is made, but to get rid of false notions about its rhythmic structure and about the necessary conditions of rhythm in general.

It is sometimes claimed that verse rhythm does not reside in the sound of the words of the verse, but in their logical and emotional content. If this were so no justification could be found for analyzing the sounds apart from their sense. But common observation gives the lie to such an assumption. Verse in an unknown tongue is abundantly rhythmical—sometimes more so than the verse we can understand, so we are even led occasionally to the false inference that foreigners chant or sing-song their verse. Moreover some of our own verse, nursery rimes as well as some very ornate poetry, is practically devoid of meaning, but maintains a strong rhythm. Many other considerations might be brought forward to substantiate the impression that the mere sounds in verse are rhythmical. But the fact is too obvious.

The psychologist is justified in undertaking an analysis of spoken verse rhythms with the reasonable expectation of obtaining from it information about the nature of rhythm in general.

CHAPTER I

Methods of Studying Verse Rhythm

(*a*) *Simple Observation by Ear*

The most natural way to study speech sounds is to listen attentively. For that no apparatus is needed and no experimental technique required. The method is still simpler if one listen to one's own voice, for then the ear is aided by the various sensations and feelings which arise in consequence of exercising the vocal organs.[1] But self-observation even when quite satisfactory to the individual is not to be trusted scientifically and can not be accepted when any other method is at hand. Direct observation of other persons' performances is, however, involved in this case with many of the same difficulties of prejudice and preoccupied attention which beset self-observation. It is hard to form a judgment about what we hear spoken, wholly on the basis of what we hear. The observer is very apt to be confused by what he would himself say, or even by what he has said or is at the very time saying under his breath as he listens to a rhythmic utterance.

The scientific objections to what is here called the observational as contrasted with the experimental method can be divided into psychological and mathematical. These objections apply to the qualitative and quantitative aspects of the results respectively. *Qualitatively* the psychologist should look with suspicion on professed facts of observation which can not be rehearsed, that is, repeated at will. Such an observation is valid, in general, only in so far as it asserts that there was a phenomenon. Analysis and qualitative determination of the phenomenon should not be attempted unless the phenomenon can be recalled and the analysis verified. Taking our own subject—verse rhythm—as an example, the reality of this difficulty is beyond doubt. Let us suppose that I sit listening to the recitation of Kingsley's "Three Fishers." When the

[1] That the sensations from the speech organs themselves are not, however, alone sufficient to give a clear impression of rhythm can be discovered by any one who will try to sing or recite verse in the presence of a great roar of sound or better still when there is a strong quick echo. Under such circumstances it is extremely difficult to maintain regular speech rhythms. When, however, the ear is functioning normally there can be no doubt that sensations attending the utterance of the sounds are of great importance in the total rhythmic effect.

recitation is done I make the following memoranda: (1) The effect was rhythmical and pleasing. (2) The rhythm was anapæstic, *i. e.*, "rising." (3) I feel that rhythmic effect is based upon the rather regular recurrence of strong accents or beats followed by unaccented syllables. (4) I find the rhythm somewhat broken.

Now so far as observation (1) is concerned there can be no difficulty. That is the statement of the presence of a phenomenon. But the other observations are attempts to analyze the situation, and, while they have a certain value, the psychologist knows that they are subject to contradiction both by other observers and by the same observer under slightly different circumstances. Thus if I listen to the same person reading the same verses another day, (the reading being as nearly as possible the same as before), I may very likely say the meter is dactylic, very regular, and based on groups of sounds of about equal time value.

Such contradictory statements arise, of course, out of the fact that observers are subject to a vast complex of emotional states and intellectual prejudices which make their uncontrolled observations extremely unreliable. Thus I hear the rhythm as dactylic when the verse affects me so as to stimulate me; I hear it as anapæstic when it depresses me. I notice and emphasize the stress or time factors according to my interest or prejudice in favor of one or another theory of versification. The rhythm is smooth or rough to me according to the degree, perhaps, in which I enter into the swing of the verse and make it my own; or perhaps the roughness is only the result of poor muscle tonus which prevents a good motor response. In any case such observations are not to be depended on because we have no assurance that they can ever be got again.

In so far as unaided observation pretends to arrive at *quantitative* results its pretensions must fail because of lack of measurement. Scientific observations are valid quantitatively only so far as the accuracy of the measurement can be determined. My mere observation of the length of time a word takes in utterance or of the relative durations of the syllables composing the word gives no measure that can be relied upon.

So far then as rhythm in verse depends upon quantitative factors (time and stress), uncontrolled observation gives no real means of determining those factors. Such a method must ultimately give way to one offering conditions of experimental control. Meanwhile it is often the only method at hand, and weak or fallacious as its determinations of fact often are it is not to be despised utterly. Mere observation and emotional reaction is the favorite procedure of the poet, and the study of verse is so close to poetry

that it is not surprising to find this simple method persisting long after more exact methods have made their appearance.

(*b*) *Phonographic Repetition*

An advance is made beyond uncontrolled observations like those of Sweet[2] or Lanier[3] by using the phonograph record as repeated by the machine.[4] I am not sure that the increased accessibility of the record (due to the fact that it can be repeated at will) any more than compensates for the inevitable distortion of the mechanical reproduction. In this respect there is no evident advantage over a frequent repetition of the same verses by the reciter. The process of reducing the speed of the repeated record, while it affords time for more accurate reactions, can not make the analysis any more reliable.

This method is open to the same objection that must be made to mere listening observation in any form. The disposition and rhythmical tendencies of the listener are not measurable and too much trust is put in the testimony of the ear. Even if more than one listener records results, though this excludes individual distortions, it can not give anything like an objectively valid measurement of the sounds uttered. The main fact so often observed and carefully examined that we construct rhythms in series which are objectively uniform and that our estimates of intensity and of time duration are beset with illusions, ought to make us mistrust all observations where such possibilities of illusion enter in.

(*c*) *Tapping*

There is another method of recording speech stress which is closely allied to the graphic method in technique but psychologically quite unrelated to it. It may be called the semi-graphic, or better, the tapping method. It permits of the use of a drum and time record and gives a permanent and indisputable account of certain movements. In this respect it is better than bare listening. But it does not record speech rhythms.

Taps or other voluntary muscular movements which are supposed to fall upon the arsis of a verse foot or upon any designated accent are marked on the drum by direct lever, by pneumatic transmission, or by electric connection.[5] It may be true as Brücke[6] claims

[2] Sweet, H., "History of English Sounds," 1888.

[3] Lanier, S., "The Science of English Verse," 1880.

[4] Wallin, *Yale Studies*, **9**, 1904; Scripture, E. W., "Elements of Experimental Phonetics," 1902.

[5] Either a signal magnet or the well-known "spark method" may be used.

[6] "Die physiologische Grundlagen der neuhochdeutschen Verkunst," 1871.

that such a movement is coordinate with the vocal stress and not subordinate to it. But his attempt at finding a constant error which might be eliminated was doomed to failure as has been abundantly shown by subsequent experiments in which this method was combined with the graphic under the most favorable conditions. Miyake[7] found that the spark set off by a tap movement might be located at widely different points in the voice curve under different conditions. Experiments of my own both by the spark method and with a pneumatic device for recording the taps show the same irregularities. No constant error was observable, the taps preceding or following the syllable with which they belonged. This is to be expected with motor functions so little connected as those of speech and hand movements.

In part the disparity found between a tapped and a voice record is accounted for by the fact that we are in the habit of tapping out rhythms with the hand or by nodding the head, etc., without regard to other rhythmic impressions. Most people have such motor rhythm habits well developed, as is abundantly testified to by the common observation of people as they "drum with their fingers" abstractedly. Such a habit being well established it becomes difficult to institute a controlled rhythmic movement of the same muscles, for they tend to relapse into the habitual movement. The tapping rhythm under such circumstances is likely to go on without respect to the voice rhythm. At any rate it is not to be expected that it will adequately represent the latter.

On the other hand the claim is justly made[8] that the tapped rhythm, which is remarkably regular and probably very nearly automatic, exercises a considerable control over vocal expression. The tapping thus becomes an objective control like an instrumental accompaniment and the proper voice rhythm is made unduly regular in obedience to this control, thereby losing its peculiar characteristics. Whether it is possible for a practised experimenter to avoid this difficulty by careful attention need not be discussed here. There is certainly no way of determining whether the internal coordination is regular in the first place, and still less is there any objective measure of the control exercised over the voice rhythm by the tapping movements.

When the object, however, is to examine the mechanical scansion of verses[9] the tapping method can not be objected to since extreme

[7] Miyake, *Studies from the Yale Psychol. Laboratory*, **10**, 1902.

[8] Wallin, *op. cit.*

[9] Hurst and McKay, *University of Toronto Studies. Psychol. Series*, **1**, 1900.

regularity is a desideratum in mechanical scansion and beating time contributes directly to this end. I must confess, however, that I fail to see what is to be gained for the study of verse by an examination of strictly scanned rhythms. They do not represent any normal rhythmical phenomenon of speech. On the other hand they do not have the characteristics of freely tapped rhythms.

The latter are highly significant in the study of rhythms and nothing which has been said above is intended as derogatory of the study of them.[10] Such pure motor rhythms, devoid as they are of ideatonal content, come nearer perhaps than any other one set of phenomena to giving a reliable instance of pure rhythm.[11] A rhythm, however, which is produced by a set of movements not directly concerned in the production of speech sounds has correspondingly no direct connection with the rhythm of those sounds. The two things are irrelevant to each other. And desirable as it is to know all about the different forms of rhythmical expression, those of the hand as well as those of the voice, nothing can be gained and all is risked by assuming that the one can be substituted for the other.

(*d*) *Reaction Methods*

Taps may be made by an observer in response to accents which he hears in a series of sounds. When such a procedure is adopted all the previous difficulties are complicated by the addition of those peculiar to the reaction time experiment. The most serious objection to the application of the reaction method in the case of a series of rhythmical sounds is that expectation enters in an extreme degree; and there is no way of discovering whether the observer is really reacting to what accents he hears or merely recording the beat of a rhythmical series of his own.[12]

When the sounds vary considerably in intensity and energy as they do in speech there is no way of ascertaining the effect of those variations upon the reaction time. The expectation is that the reaction time will be shorter for the more intense sounds[13] but no very close correction can be made with the data at hand in such an experiment. The occurrence of the sounds being quite irregular and each preceding sound serving as a signal for the succeeding

[10] McDougall, R., *Psychol. Rev. Mon. Sup.*, Vol. IV.

[11] Compare Meumann's discussion of the effect of content or meaning upon rhythms, *Philos. Studien*, **10**, 393, 1894.

[12] Compare, for instance, the anticipatory reactions in the ordinary "complication experiment."

[13] Froeberg, "The Relation of the Magnitude of Stimulus to the Time of Reaction," these *Archives*, No. 8, 1907.

one complicates the situation very seriously and inevitably leads to great variability in the reaction times.

In point of fact this method when applied to actual verses is only a better form of the method of observation with which this kind of study began. In that it supplies an accurate measure of the variability of the observations it has certain advantages.[14] But what it gains in mathematical accuracy it loses in psychological reliability through the interference of the observer's own rhythmical tendencies as an indeterminate factor.[15]

(*e*) *Determination of Subjective Rhythms*

If, however, the object of an experimenter is to ascertain these very rhythmical tendencies of his subject he is abundantly justified in the use of a reaction method.[16] It should be understood, however, at the outset that the determination of the subjective tendencies of a subject to rhythmize certain auditory or other sensations has little or nothing to do with a determination of that subject's rhythmic utterances or movements. This point has been too often lost sight of.

Psychologically it makes all the difference whether I hear the supposedly similar ticks of a clock and group them into some such rhythmical order as *tick-tock, tick-tock,* or whether on the other hand, I amuse myself by repeating the words *tick, tock* in a rhythmical series. In the one case there is a very complicated perceptive or affective situation (psychologists differ in their analysis of it) where the observer groups certain discrete impressions into fresh units supplied by himself while he is all the while subject to illusions of time and accent which make him feel that the ticks he hears are unequal in force and separated by unequal intervals of time. That is the one case; perceptive or affective, or both, and difficult of analysis.

In the other case I simply make certain movements which some one else or I myself call rhythmical. In this case all we need to do is to measure those movements. We do not have to enquire further how and why the movements give rise to a rhythmical impression. It is sufficient that they do so. To refuse to recognize the distinction here drawn is to ignore the division between de-

[14] McDougall, *Psychol. Rev. Mon. Sup.,* Vol. IV., 393, 1903.

[15] There is a distinct difference between this method—where the sound is heard and reacted to—and the tapping method, where two movements are coordinated.

[16] Bolton, T. L., *Amer. Jour. of Psychol.,* **6,** 1893; Miner, *Psychol. Rev. Mon. Sup.,* No. 21, 1903; Ebhardt, K., *Ztschr. f. Psychol.,* **18,** 1898; Bücker, *Abh. d. Sächs. Ges. d. Wiss.,* **17,** 1896.

ductive and analytic methods and those of induction. Any single analysis of a verse of poetry as regards its rhythmic constituents involves a working definition of rhythm in general and of verse rhythms in particular. One can not analyze these things without knowing what to look for.

The inductive procedure on the contrary is perfectly direct and requires no presuppositions whatever. If the sounds of a verse are admitted to be rhythmical nothing remains but the comparatively simple description of what the verse is made of acoustically. Admittedly no inductive procedure ever gives final results and no one denies the necessity of an analysis and generalization from the ascertained facts. But far too much effort has been wasted on vain attempts to analyze verse without any facts at all or with the most loose and inaccurate observations. Such analyses are bound to fail, and it is no wonder that the theory of versification is burdened with a mass of contradictory and ill-grounded generalization. For the most part such generalizations rest on individual observation and more or less chimerical theories of the nature of rhythm and time. The accurate records of concrete instances of rhythmical verses are so few as to be utterly lost in the verbiage of the philologists and metrists.

(*f*) *Experimental Method*

The method of the experimental psychologist with its peculiar excellencies also has its own defects like all the other methods. The psychologist may indeed feel envious at times of the rapidity and seeming success of methods more systematic and theoretical than his. The experimental method at best seems to be all too slow and when one must carry it to the still further degree of considering the human elements in the obscure phenomena the restraint becomes onerous. None the less the demands of scientific exactness must be met sooner or later. A few well sifted theories may endure for a long time but all at last will be brought to the bar of human experience and made to give an account of themselves. In so far as the method of psychology is first of all that of determining the characteristics of any given particular human experience it is to psychology and psychologists that the task falls of examining and criticizing those theories which pretend to formulate any given set of experiences or aspect of an experience.[17]

[17] Experiments which have to do with the esthetic attitude of the subject toward a rhythmical series; with his appreciation of rhythm; his ability to discover rhythm in a regular or irregular series; or with his reactions to supposedly rhythmical situations fall without the scope of a study of the actual rhythmical series. Such work will be referred to in these pages only as it has suggested and led up to more strictly empirical methods.

The experience of rhythm is one of those which can profitably be made the subject of theoretical and schematic discussion up to a certain point. Beyond that point nothing can take the place of a sober consideration of the facts experienced and the resulting experience. The judgment of an observer is final upon the question of the existence or non-existence of a rhythm, just as it is final on the existence of any other phenomena of consciousness. Whatever the definition of rhythm, the occurrence of the state of mind can not be doubted. Others may claim that there are rhythms which go on unperceived by the particular observer and not affecting him. And from some point of view that may be true. But the psychologist is only concerned with a rhythm that is felt. Here as always it is the duty of the psychologist to take account of the positive cases irrespective of the number of negative cases. The latter may be made use of under particular conditions of experimentation but most of them are without significance. For a man who has had one vivid hallucinatory experience, the absence of them during the rest of his life is irrelevant; and the psychologist above all, is concerned with the particular conditions of that particular experience. When difference tones are heard with two notes of a certain interval or when colored after-images are present for some time after looking at a bright white light it is the positive phenomena which are made the object of investigation. It matters very little that some individuals can never hear such difference tones or that most of us live through similar conditions with respect to bright lights a hundred times without being conscious of the after-images which a little attention could make vivid. The psychologist can do nothing with difference tones and after-images that are not heard and seen. His business has to do with the phenomena that are heard and seen. The judgment of an observer is the one indispensable requisite for the pursuit of the psychological method.

So it is with the case of rhythm. Its presence must be recognized before it has psychological existence. And, on the other hand, its existence can not be denied when it is present according to some one's deliberate judgment. An observer's judgment must receive just as much consideration no matter how divergent it may be from the consensus of opinion or from established doctrine.

In questions of esthetic appreciation the difference is most striking between the ordinary unscientific method and the method of psychology. The common distinction of "good" and "bad" taste in matters of art stands in direct opposition to the eminently more psychological dictum, *de gustibus non disputandum.* The conditions

under which esthetic feelings occur can be defined more or less accurately, but this can be done only by observing actual cases of their occurrence; never by laying down rules about what ought and what ought not to be appreciated. Such rules rest on a consideration of the subject-matter. The only valid conclusions rest on the description of phenomena experienced.

Rhythm and verse are so closely related to art forms that their theory has been exposed to much the same abuses as the theory of the corresponding art products. When poetry is defined a priori it is easy to go on to a definition of verse in the same way. In fact one definition demands the other generally, as a prop. Verse and verse rhythm, however, can not be defined a priori.

Such being the case, the psychologist is bound to seek out the actual facts, and build up from them an empirical description of the phenomena. Experimentation is the method which the scientifically minded psychologist adopts to secure observations as free as possible from error. Fortunately it is no longer necessary to defend experimentation as a method of approaching many of the questions which were made the subject of uncontrolled observation in the past. It is sufficient to say that we employ experiments because only by so doing is it possible to secure *measurements* under conditions permitting of *repetition at will.* The extension of this method to the study of verse is justified, therefore, by the failure of any other method to maintain those two requisites of scientific exactness.

CHAPTER II

Graphic Method and Mechanical Aids

Once granted that there is profit in experimentally analyzing verse with regard to its sounds apart from its sense, the question arises how mechanical means can be adapted to the purpose, thereby eliminating the illusions and errors of observation to which unaided human ears are liable. Attempts to record the voice automatically in such a way that the record can be subsequently studied at leisure have been numberless. Many have failed, others have had a certain measure of success. But in so far as they are all attempts to translate the temporal sound series into a visible record in space they fall under what has come to be known as the "graphic method." The name "graphic method" is applied to two very different things. So far as it refers to graphic methods of presenting quantitative facts in the form of plots and various kinds of graphs it does not concern us at the moment. More strictly the term is applied to any kind of direct registration upon paper or a similar surface by a stylus or pen. The facts which are registered in this way include changes of temperature; time series; the velocity and force of movement both of bodies and muscles; the pressure of gases and liquids; wave movements in various media; and a great number of physiological cycles such as respiration, pulse, etc. Under registration of waves of course comes sound registration. Another very interesting field is that of stroboscopic photography. Ordinary photography would not be classed as a graphic method, but it is often of great assistance as a secondary aid in the application of the method proper. No mere record of a static fact is included in the scope of the graphic method. It applies only to the registration of changes or movements of some kind.

The earliest application was in the registration of meteorological data, and in that field its successful employment has gradually spread until at the present time almost all scientific measurements of these facts are made automatically. In the Weather Bureau stations for instance measurements of temperature, barometric pressure, wind velocity and humidity are seldom or never read directly from the instruments. In fact many of the instruments do not permit of direct reading. Nevertheless the measurements obtained are even more accurate than the most careful direct reading. One of the most interesting examples of this type of graphic record is

the seismograph in its different forms, serving to record the amplitude and directions of tremors in the earth's crust.

The graphic method was applied to meteorology before the middle of the eighteenth century, particularly in the form of curves for temperature and wind pressure recorded on a continuous roll of paper (le Marquis d'Ous-en-Bray 1734), or on smoked paper (Rutherford 1774).

Next to the invention of the method itself in importance stands the control of it by the introduction of a time record on the same sheet. When the revolution of the clock or other mechanism commonly used is perfectly regular the time can be read off from the space between any two marks of the pen upon the paper; but it is generally safer to make use of a distinct time record writing a line along beside the others which are being made. Without such a time record the apparatus is, technically speaking "uncontrolled." For this indispensible contribution we are indebted to Thos. Young who employed the oscillations of a simple vibrating reed. Duhamel replaced this by a tuning fork, and later Helmholtz, Regnault and Foucault introduced the electrically controlled tuning fork; and finally Marcel Deprez developed the "signal magnet," which has become one of the indispensable accessories of the modern laboratory. James Watt used the graphic method to record steam pressure and its employment in the physical sciences has steadily extended in scope. The Ludwig kymograph (not the drum alone) was invented in 1847. The principle was applied by Volkmann, Helmholtz, Vierordt, and others in Germany, to the registration of the heart beat, respiration, and muscle action. In 1857 Vierordt and Tubingen announced the sphygmograph, and it was this that interested the Frenchman, Marey in the possibilities of such registration. To him we owe much of the later development of precise methods not only in application to physiological problems but to nearly every field of experimental investigation. Thanks to his ceaseless devotion the method is now available not only for the recording and presenting of facts in a compact and convincing form but for the recording of many facts too minute or too ephemeral for direct observation. In Marey's hands a registering instrument is transformed into an instrument of precision, an indispensable tool.

In no one field has the graphic method afforded such diverse applications as in the recording of sound. The manometric flame makes it possible to analyze all the most complex compound musical notes and on the other hand the phonograph makes it possible to reproduce sounds of all sorts with extreme accuracy. The one method makes possible an accurate science of acoustics; the other

not only seems to give pleasure to great numbers of people but is a tremendous aid in the study of phonetics. Neither of the methods, however, is strictly in line with the classical form of the graphic method. Scripture[1] and others[2] have used a curve taken from the recording part of the phonograph and have studied this as a record of the sounds which can be reproduced from it. Such a record whether taken on a revolving disk as in the gramophone or cut out from the wax surface of a cylinder as in the Edison phonograph is a genuine graphic record. Such records can be studied, however, only with the microscope or after great expense of time in enlarging according to the method proposed by Scripture and to some extent carried out by him. Such work is more valuable for detail of sounds than for the longer stretches of connected discourse.

As early as 1856 an attempt was made to construct a recording device for speech imitating the arrangement of the ear. This is the artificial ear or phonautograph of Scott.[3] Such an instrument consists essentially of a receiving horn and a diaphragm of some sort which actuates a lever writing on some surface. Various developments along this line are chronicled by Scripture in his "Elements of Experimental Phonetics."[4] The friction of the lever attachment can be got rid of by substituting an electrical contact as in the "voice key" of Cattell[5] and Scripture.[6] A more elaborate form of the same device is found in Rousselot's electric recorder.[7]

All the instruments of this class show the same limitations that were spoken of in the case of the manometric flame and photographic methods; namely, that the record is limited to only comparatively pure sounds or notes. The more complex or obscure sounds are not at all adequately represented. Increased perfection of the mechanism gives more and more detail in regard to the shape and amplitude of the sound waves, but the piling up of such an amount of detail soon makes it quite impossible to interpret such records with profit. The phonograph record is the only one of all the devices so far mentioned which is adapted to record long stretches of continuous speech and the interpretation of its record as Scripture himself admits[8] is such a problem in itself that there

[1] "Elements of Experimental Phonetics," also *Yale Studies*, **10**, 1902.

[2] Marichelle, "La parole d'après le tracé phonographique"; Lloyd, *Jour. Anat. and Physiol.*, **31**, 1897; Marage, *L'Année psychologique*, **5**, 1899.

[3] Inscription automatique des sons de l'air au moyen d'une oreille artificielle.

[4] See also *Yale Studies*, **7**, 1899.

[5] *Phil. Studien*, **3**, 1886.

[6] *Yale Studies*, **3**, 1895.

[7] "Principes de la phonétique expérimentale," 1902.

[8] "Researches in Experimental Phonetics," 1906, p. 4.

is little hope of ever accumulating any quantity of experimental data in regard to verse in this way.

The disciples of Marey and particularly the investigators under Rousselot in his laboratory of the Collège de France have come nearer than any one else to solving the difficulties of obtaining a legible record of speech sounds. Their methods include the recording of lip and tongue and palate movements by direct levers writing on a revolving drum or by electrical keys connecting with such levers. More adequate are the various devices for recording the vibrations arising from the larynx, either by a pneumatic bulb placed against the throat and connecting with a Marey tambour writing upon a drum, or by a device placed in the same way but equipped with a mechanism for interrupting an electric current.[9] Most successful of all, however, is the device now in general use in slightly different forms in many laboratories by which the breath as well as the sounds of the speaker's voice are conducted directly to a tambour and there recorded on the drum.

The apparatus which I have used for the analysis of verse does not differ in any essential from that described independently by Rousselot and Meyer.[10] For the particular purpose of noting rhythmic time values less delicate records are required than for the study of strictly phonetic questions. Accordingly the apparatus is made as simple as possible and the rate of revolution of the drum reduced to about 2 cm. per second so that the labor of measuring the time is reduced to a minimum; the error of measurement is still less than one one-hundredth second for each syllable measured.

In my experiments on nonsense syllables the time line was given by a clock beating seconds; the records were then measured (under a lens of course) in linear units and the proper corrections made for the speed of the drum during any given second.

In the later experiments with actual verse a vibrating reed was employed to interrupt the electric current through a time marker every tenth of a second. The rate of the reed was kept constant and frequently tested by means of an electric counter inserted in the circuit. The rate of the reed was never so much as one tenth second fast or slow per minute; that is, it did not gain or lose as much as one count in six hundred. The regularity of the time line thus obtained was equal as nearly as could be measured to that of a 100 vs. Koenig tuning fork writing a parallel record.

The essential part of the apparatus is the tambour. It should

[9] For a fuller account of these devices see Marey, "La methode graphique," 1878, p. 309; Rousselot, *La parole*, N. S., **1**, 1, 401, 769, 1899.

[10] *Die neueren Sprachen*, **6**, 123, 1899.

be as small and light as possible to insure the greatest liveliness and responsiveness. When sufficient vivacity is obtained not so much attention need be paid to the accuracy with which the details of wave forms are recorded. The principal result to be arrived at is a quick response to the first breath and to the first vowel vibration and a comparatively quick return to rest when the breath and sound cease. If the initial and final points of a sound are well defined further details can be dispensed with so far as the rhythm is concerned. In the interest of lively action I have found it best to use a very small capsule for the tambour (not over $\frac{5}{8}$-inch in diameter and $\frac{1}{4}$-inch in depth) covered by a rubber membrane of fairly light weight pretty well stretched. The writing lever is of split bamboo about five inches long, one and one half inches being in the short arm. It rests in a delicate cone bearing, and is attached firmly by sealing wax to a small rest (this can be made of paper) gummed to the rubber membrane. A gelatine writing tip can be used but there is less friction if the bamboo is whittled to a very fine point and no other tip added. A certain loss in delicacy of tracing is more than made up for by relieving the lever of any unnecessary weight and at the same time increasing the smoothness of the tip.

The tube for admitting the air to the tambour can as well enter at the side as the base of the drum, and when particular attention is to be paid to vowel vibrations I have found it worth while to replace the solid metal base of the drum by a paper or mica diaphragm. This seems to act as a resonator opposite the rubber membrane and reinforces the vibrations of the latter. The vibrations of such a diaphragm are not, however, of sufficient amplitude to make an independent record.

Unfortunately our knowledge of tambours is only empirical and of several which appear very much alike perhaps only one or two will give good records of sound vibrations. Fortunately, however, tambours of various sizes and proportions can be constructed and set up very easily. It is best to have one or two carefully constructed levers with a fine cone bearing arranged on a sleeve which can be slipped onto any tambour stem. It is also convenient to be able to slip off the bearing and lever when replacing the rubber membrane. The latter can then be adjusted without fear of injuring the delicate lever and bearing. A fine insulated copper wire is much more convenient than the usual thread for fastening the membrane.

The tube connecting mouthpiece and tambour should be as short as the convenient placing of the speaker will permit. A few inches more or less does not, however, interfere appreciably with the good

action of the recording apparatus. I use a tube of rather stiff rubber about two feet long and of $\frac{1}{8}$-inch bore.

When one subject is to serve for any number of readings it is well to make a plaster cast of the lower part of his face, hollow it out around the lips, and use it as a mouthpiece. Such a mask requires a minimum of attention from the reader during the experiment. He simply holds it easily against his face with his left hand. The mask, however, is by no means necessary. Precisely the same results can be had by using a rubber bell of about three inches diameter such as can be obtained in various sizes in hardware stores for the use of plumbers. The only difficulty here is that the bell must be pressed by the hand into the right shape to fit the face; most readers require a little practise before they learn to handle it just right.

This apparatus is so simple, so easy to construct and use that one is surprised that it has not come into more general use in the study of various speech curves. It is as accurate as is desirable for most phonetic points and its operation requires no elaborate laboratory equipment nor special technique. The curves themselves are comparatively easy to decipher and the labor involved in this part of the work though great is far less than that of deciphering phonograph records. Any loss in accuracy in the curve as compared with that of the phonograph is more than made up by the saving of time whereby it becomes possible to multiply the number of records and so correct the error of any one. Moreover it is very desirable to have a considerable number of records of the same words for purposes of comparison and the detection of chance variations in the enunciation. No other apparatus yields so many records taken, if desirable, at one sitting and under the same conditions. The interpretation of the curves is as stated above comparatively simple. It is, of course, laborious as in all exact measurement. Practise is required in deciphering the records of each particular speaker, for each one has his characteristic tricks of enunciation which give a distinctive form to the curve. Each consonant and consonant group has a peculiar record due to the way in which the breath is controlled in uttering it. Thus *p, t, d, k,* show a sharp vertical rise of the lever and a quick recovery, *s* and *ch* a gradual rise and irregular fall. The more distinctive of these consonants serve as landmarks in the record, and they must be learned for each speaker. The records can be read off roughly with the naked eye, but for the finer points some magnification is necessary. A watch maker's lens of about three inches focal length is all that is required.

Since some sounds make a sharper and more characteristic curve than others it is desirable to choose such phrases for study as contain those distinctive sounds at the critical points of the record. Selection of phrases on such a basis does not prejudice the result in any way, and at the same time forestalls any question about the accuracy of the curve as a record of the sounds. When there is any difficulty about interpreting the records the process is facilitated by getting the reader to speak the separate syllables or words involved singly, or in small groups, which can be identified at once and marked in the record. A comparison of the whole record with these fragments will often clear up obscure points in the former.

No doubt this simple apparatus is capable of improvement, but at present it is the best there is for the purpose and in most respects it is entirely satisfactory.

CHAPTER III

Pitch, Intensity and Duration

Physically considered speech sounds are characterized by intensity, duration and pitch or quality. But not all of these are of equal importance for verse. The present enquiry is concerned with one of these factors only, that of duration. The others can not be left out of account for they enter intimately into the time relations of every rhythm; but the method as well as the purposes which I have outlined prevents a complete consideration of anything but the time relations. Graphic experimentation yields but poor results for instance, in the case of pitch. The pitch of clear vowels when sung can be measured,[1] but the vowels of ordinary speech are so complex that no system of analysis into simple components is adequate. In fact the work of Scripture[2] seems to prove beyond question that vowel sounds do not consist of a fundamental combined with resonating partials but that they are unstable compounds constantly changing in wave form. If this is so the task of measuring them is rendered doubly difficult. Despite Scripture's[3] elaborate arguments I do not believe that we can trust the gramophone curve as being more accurate than the reproduced sound. Just the opposite may be true. But the phonograph or the gramophone record is the most refined graphic record we have at the present time. In view of all this we are compelled to neglect for the present the pitch and quality aspects of speech sounds. Any complete account of speech rhythm must take them into account. They are perhaps more important for prose rhythm (if there is such a thing)[4] than for verse.

The connection between intensity and duration is almost as hard to discover experimentally but it occupies such a large place in the historical theories of verse rhythm that it must be examined more closely. We are confronted here with exceptional difficulties,[5] such that present day physics, phonetics and psychology are helpless before them. Linguistic sounds are myriad, each differing from

[1] Cameron, *Psychol. Rev. Mon. Sup.*, No. 34, 1907.

[2] "Researches in Experimental Phonetics," p. 146.

[3] *Ibid.*, p. 17.

[4] Lipsky, "Rhythm as a Distinguishing Characteristic of Prose Style," these *Archives*, No. 4, 1907.

[5] Bourdon, *L'Année psychologique*, 1897, p. 372.

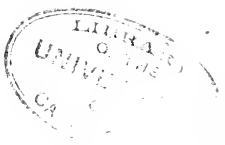
every other in loudness and quality. If we limit ourselves to the English language alone we find that every individual who uses it has his own private way of modulating, accentuating, and toning it, and so characteristically that we are less likely to confuse two human voices than we are two human faces.

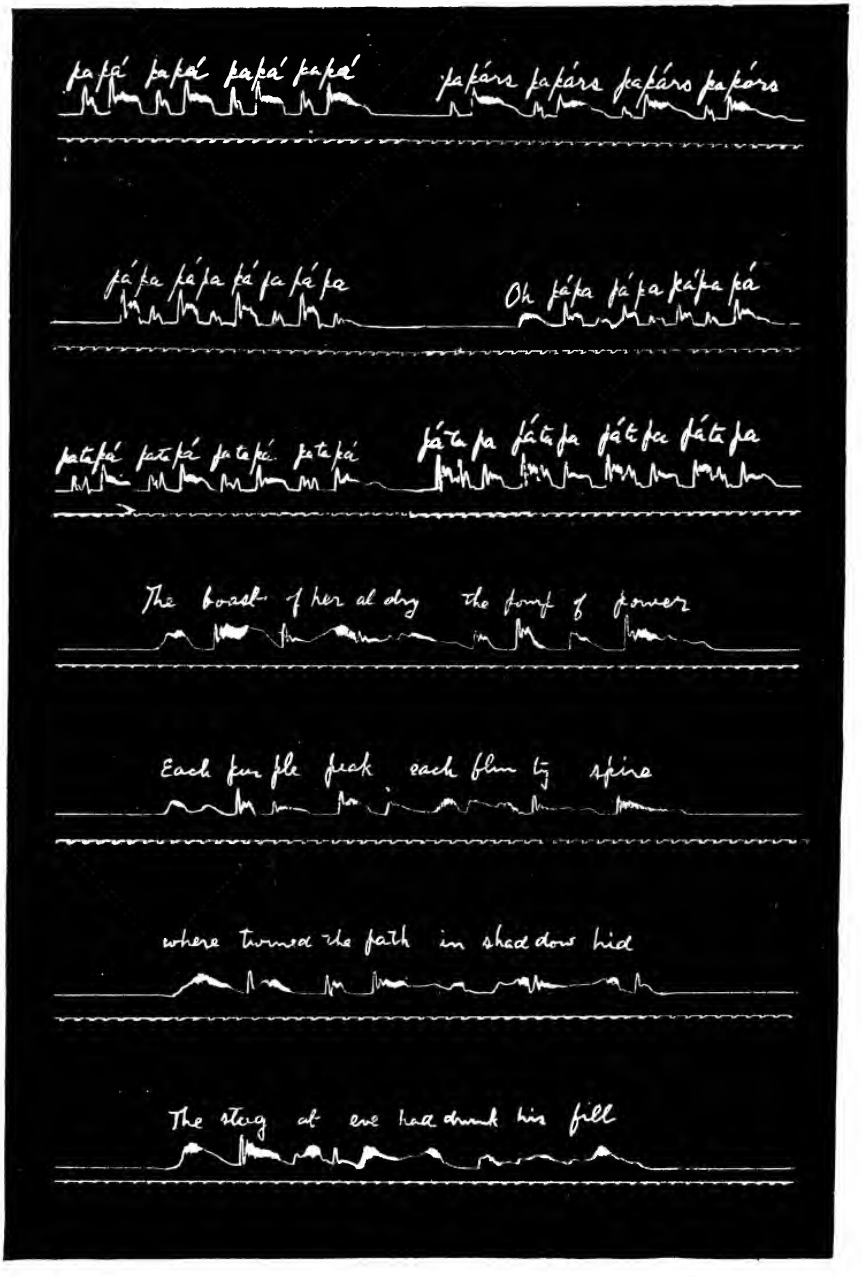
Now it is possible to compare the physical intensities of two sounds of the same wave-length (pitch) provided they have the same quality (overtones or partials), but we have no physical measurement of the intensities of sound differing in pitch and quality. This being the situation, how hopeless is the task of determining the relative intensity of sounds which differ so widely in quality as, for instance, the sounds of the words *it* and *aim*. Moreover in speech we have practically a continuous flow of sound, and the determination of points of maximum intensity must be made with respect to a very small element of the total series, not with respect to large masses of continuous uniform sound. Even if we had a means of comparing "it" and "aim" taken separately and as units little advance would have been made toward the determination of the points of greatest intensity and the comparison of such intensities when found in a sentence like "it is my aim." And even supposing that some way were found of comparing these intensities for a given speaker at a given time there is no way of applying an absolute standard by which these accents could be compared with others. There is no such thing as a standard of intensity of sound.

If on the other hand we abandon the attempt to obtain objective spatial measurements of the accents in speech and fall back upon our psychological perception of their presence and relative magnitude new difficulties arise to confront us. Let any one say to himself the two words *booty* and *hoot* and try to discover the location with any exactness of the greatest stress within either word. Does it lie just as the *b* bursts into the vowel in *booty,* or in the long *oo* sound in either case? If the observation is made while some one else pronounces the words the results will probably be different. This is a hard thing to do. It is still harder to draw a curve representing the rise and fall of the stress up to and down from the point of greatest intensity.

All this is supposing that the stress is one of loudness only. But there is small probability that it is so. More likely the accented syllable is also prolonged in time and altered in pitch. In that case we are still quite well able to tell on what "syllable" the accent falls but further than that our ear does not tell much.[6]

[6] The application of the tapping method (McDougall) offers a possible solution. If a pneumatic system is used for recording the taps it is possible to




papá papá papá papá papá papáro papáro papáro papáro
páka páka páka páka páka Oh páka páka páka páka
patapá patapá patapá patapá pátapa pátapa pátapa pátapa
The boast of her al dry the fount of power
Each fun ple prick each flun ty spine
where turned the path in shad dow hid
The stag at eve had drunk his fill

As has been frequently insisted upon, speech, and particularly rhythmical speech flows almost continuously. Its rhythm is, therefore, more like that of a singing tea-kettle or humming electric motor, than it is like the rhythm of a metronome. This distinction can not be too much emphasized. The investigation of rhythm has been confined almost exclusively to the latter type—the type made up of discrete elements. Perhaps more headway would have been made in the general theory if the type which arises in a continuum had received more attention. A word of caution is needed against inferring very much about verse rhythm, which is of this continuous type, from experiments in tapping and listening to series of discrete sounds. The two things are far from alike.

The reaction method of study is found in its least objectionable form when the reaction is made to a qualitatively distinct member of a rhythmic series of discrete stimuli. It does not follow, however, that it is equally applicable in the case of a continuous flow of sound. Miyake[7] found that the stress is often marked by a tap before the beginning of a sound. I have found the same. Brücke,[8] however, found that the taps fell within or near the end of an initial vowel. Meyer[9] concludes that the maximum stress falls, with the tap, just within the initial consonant sound before it passes into the following vowel. He assumes perfect coordination of tap with vocal stress. These contradictory results are easily understood from the point of view of the difficulty we feel in locating our own stress, but that the stress should precede the sound is absurd from the point of view of one who listens to the sounds.

The graphic method can give little help on this point. A glance at one of the accompanying records will serve to indicate its shortcomings. The vowel sounds are indicated by a low, generally flat, serrated stretch; certain of the more explosive consonants by a sharp rise and a more or less gradual fall of the curve; the nasals by nearly flat stretches; sibilants and aspirates by a comparatively slow upward movement. It may be possible to measure roughly the intensity of vowel sounds by the amplitude of the vibrations as recorded. Some consonants would be measured by the amount of breath expelled; this would not apply to all of the consonants however. In any event no comparison is possible between vowels and consonants as regards

record their intensity as well as the interval of time between them. Nevertheless it is a long jump to the intensity of a sound or speech movement from the intensity of a tap coordinated with it.

[7] *Studies from the Yale Psychol. Laboratory,* **10**, 45, 1902.

[8] "Die physiol. Grundlage der neuhochdeutschen Verskunst," p. 24.

[9] *Die neueren Sprachen,* **6**, 122, 1899.

stress nor between different vowels. It is even doubtful whether the same consonants can be compared with each other in view of the different form of the breath curve under varying stress.

On the whole I think it sensible frankly to admit the impossibility of any exact analysis of verse with respect to either loudness or intensity in the more psychologically correct connotation which embraces all the factors that give a stressed syllable weight or impressiveness. We can determine by ear roughly the syllable stressed by a reader and I have simply made measurements from the beginning of one such syllable to the beginning of the next on the assumption that the stress wherever it lies is not far from the beginning of the syllable. That this assumption is not scientific can not be denied. The result is that what I shall have to say about the position of the stress will necessarily lack such precision as is aimed at in the case of the measurement of the durations and proportions of syllables.

The graphic method is peculiarly adapted to the determination of time intervals, hence its applicability to the measurement of the duration of speech sounds. In view of the fact that our interest is primarily in the time relations of the verses which are to be studied the results which our method yields in this respect more than compensate for its inadequacy in recording pitch and intensity.

Scripture[10] has published a few records of complete verses carefully measured off from enlarged gramophone records. Such records are of great value but the excessive amount of time and work involved in obtaining them prohibits their employment in any great number. Stetson[11] also publishes measurements from one entire stanza of verse. Meyer[12] has measured all the English vowel sounds stressed and unstressed, and many of the consonants in words of different lengths and in different positions, initial, medial and terminal. His records are taken with a modification of the pneumatic voice recorder of Rousselot, but invented by himself. The instrument is like that used in the present investigation except that the breath is allowed to escape through a gap which is left between two sections of the connecting tube.[13] The records obtained are clear and the time values given for the different letters seem to

[10] *Yale Studies*, **10**; "Elements of Exp. Phonetics"; "Researches in Experimental Phonetics."

[11] *Psychol. Rev. Mon. Sup.*, Vol. IV.

[12] Skrifter Kongl. Humanistiska Vetenskaps-Samfundet Upsala, **8**, 1903.

[13] The advantage of allowing free egress for the air is that the pen recovers very quickly from the sharp rise due to an explosive consonant. This results in a more jagged curve and the apparent advantage is, in my opinion, overbalanced by the loss of characteristic slopes.

be accurate to at least one one-hundredth of a second. Such accuracy is not required for ordinary rhythm work.

The importance of having actual measurements of the duration of verse sounds will be realized by any one who has even a superficial acquaintance with the long arguments of the metrists on the place of classical or quantitative verse in English. The present investigation was undertaken with the end in view of either justifying one or the other of the prominent views of theorists on this subject or else of dismissing all of them from the position of prominence which they now occupy in the discussion of verse rhythm.

Before taking up the actual results of experiment it will be well to review some of the more important theories on this point of the importance of the factor of duration.

CHAPTER IV

Time Relations in the Theories of the Metrists and Poets

This is no place to go into details of literary disputes, but the opinions of some of the best writers and critics of verse deserve notice because they are the opinions of exceptional observers; and while their method was faulty their conclusions are often deserving of consideration.

Verse, says Poe, is inferior or less capable music. "Verse originates in the human enjoyment of equality," and man derives enjoyment from his perception of equality. A hypothetical history of the development of verse would begin with the spondee, "words of two syllables equally accented." This becoming monotonous would lead to the collection "of two or more words formed each of two syllables differently accented (that is to say, short and long) but having the same order in each word—in other terms of collecting two or more iambuses or two or more trochees. And here let me pause to assert that more pitiable nonsense has been written on this topic of *long* and *short* syllables than on any other subject under the sun. In general a syllable is long or short, just as it is easy or difficult of enunciation. The natural long syllables are those encumbered, the natural short syllables are those unencumbered, with consonants; all the rest is mere artificiality and jargon." "Of course it is not the vowel that is long but the syllable of which the vowel is a part." "It will be seen that the length of a syllable, depending on the difficulty or facility of its enunciation, must have great variety in various syllables; but for purposes of verse we suppose a long syllable equal to two short ones, and the natural deviations from this relativeness we correct in perusal. The more closely our long syllables approach this relation with our short ones the better, *ceteris paribus,* will be our verse; but if the relation does not exist of itself we force it by emphasis, which can, of course make any syllable as long as desired; or by an effort we can pronounce with unnatural brevity a syllable that is not too long. Accented syllables are, of course, always long, but when unencumbered with consonants must be classed among the *unnaturally* long." "In fine every long syllable must of its own accord occupy in its utterance, or must be made to occupy, precisely the time demanded for two short ones.

The only exception to this rule is found in the cæsura.''[1] A very full bibliography of the ''pitiable nonsense'' to which our great American poet refers can now be found in Omond's ''English Metrists.'' Much that has been written on the subject is certainly foolish; yet we find as early as 1776 that Joshua Steele was proposing[2] the scansion of verse by musical feet. Poe's proposal amounts practically to the same thing except that he limits his verse to notes of only two lengths. The real difference between this and the classical notion of verse is important; for the Poe theory, which I shall hereafter call the musical theory, starts out with an assumption of equal time values for the feet, that is, for the rhythmic units, in the verse. The theory of verse descended from classical times and which has been fighting always for a place in English versification, did not go beyond a statement of the ratio said to hold between the long and short syllables in any single foot. Both the classical theory and that of Poe are interesting for us in that they place such great stress on the time element in the rhythm.

Neither Poe nor Lanier whose ''Science of English Verse'' contains the ablest and most satisfactory exposition of the music theory of verse, says what he would measure as the length of a foot or syllable. But, as they do not provide for any vacant spaces between their syllables, I presume that they would measure as I have done from the beginning of one syllable to the beginning of the next. This is what we do in music, but in that case there is no gap. As a rule the flow of the voice is practically continuous. In fact it is often difficult to tell where to dismember two syllables and in such cases the experimenter has to rely on his ear as the court of last resort. In some words like ''porridge'' (Table XIV.) it is quite impossible to divide the syllables and I have had to measure the two syllables together.[3]

A very few cases of actually measured verses (see tables) are sufficient to show the artificiality of such a system as that of Lanier. So far as the equality of feet and the equivalence of syllables to musical notes is concerned his theorizing is utterly unwarranted. And in this case we see how easy it is for a serious student and a good poet to make observations about time values which bear no faintest resemblance to the facts. It is seldom that the method of mere observation and of introspection can be so plainly convicted; yet doubtless many of our ordinary judgments are as far from the

[1] All from the first few pages of "The Rationale of Verse."

[2] "Prosodia Rationalis."

[3] Cf. Meyer, *Die neueren Sprachen*, **6**, 479, 1899.

truth in cases where there is no way of securing experimental evidence.

One of the more recent exponents of the music theory is Dabney.[4] Verse, he holds, is measured by accent as music is divided into feet of equal length. "The basic principle of verse is *time;* measurements of time; uniform measurements of time; which measurements are represented by *words.*" (p. 27). Another elaborate treatise is that of Raymond.[5] Rhythm in verse according to him is "an effect produced by a consecutive series of sounds, or multiples of sounds, which, in themselves, may be varied and complex; but each series of which is of like duration" (p. 53).

But for Raymond as well as Dabney accent is fundamental in marking off the measures. Even so their introspection is no better than Lanier's for our figures come very far off from the equalities upon which they insist.

Some question may arise at this point about the marking on the graphic record of the point of accent. It is doubtful whether such writers as Raymond mean the beginning of the accented syllable as the point of greatest stress of voice. As has been said already, the latter point can not be satisfactorily determined. On the whole I have decided to consider only the beginning of the syllables. By doing this a great amount of work is avoided—work not only laborious but of an extremely unreliable sort. There are certain theories as we have seen which require measurements from the beginning of the syllables; if other measurements must be made from some hypothetical "Arsengipfel" the work of measuring would be doubled. But this consideration would not have affected me had it been possible to find any such Arsengipfel or top point of stress. It has not been possible to do so and I am convinced that the beginning of the sound is a safer place to measure from than any other one point. The maximal point is bound to lie very close to it either before or after and the amount of error in taking this point is small compared with the amount of the irregularity of total feet.

Other exponents of the equal time theory are Barham[6] and Omond.[7] The latter's book is particularly sane as regards everything but his insistence on the temporal equality of all units. Omond, however, does not insist on a strict equality of formal feet (p. 80), and admits that a syllable may be on the border line between

[4] "The Musical Basis of Verse," 1901.

[5] "Rhythm and Harmony in Poetry and Music," 1895.

[6] *Philolog. Soc. Trans.*, 1860–1, part 1, p. 45.

[7] "A Study of Metre," 1903.

two feet. This, however, is a license, and only for the sake of variety.

John Ruskin[8] asserts that "measured times of utterance are the basis of verse" but also that "stress accent and quality are the same"; and Coventry Patmore[9] maintains likewise that accents are separated by isochronous intervals.

"Our present verse" says Sweet[10] "is based mainly on the natural stress of the language, each strong stress marking the beginning of a foot (bar). But the stress-groups of ordinary speech amount to nothing more than prose: to make these stress groups into metrical feet it is necessary to have them of equal (or proportionate) length, and in English verse we lengthen or shorten syllables without scruple in order to make the feet of the requisite length." In Schipper's[11] monumental work a place is made for measured as well as accented verse in English. He does not go to such an extreme as Sweet, however, even in the case of what he holds to be measured rather than accentual verse.

Milton[12] speaks of the musical delight in poetry which "consists only in apt numbers, fit quantity of syllables, and the sense variously drawn out from one verse into another." Chas. Kingsley[13] holds that English verse is not regulated by accent but by length of syllable. Gummere[14] while holding (p. 144) that quantity is a secondary factor says that (p. 137) "we do not utterly refuse to recognize it as an element of verse," and that (p. 137) "that poetry which depends for metrical effect on detailed time relations (quantity) will come nearer to music than the poetry which depends chiefly on stress relations (intensity, accent)."[15]

In discussing those authorities who maintain that time relations are the fundamental thing in English verse constant reference must be made to others who place the emphasis on accent. The advocates of this other position are rather sharply divided into two classes, those who hold that accent is primary but that the time relations of the accents are significant, and those who hold that accent or accent and number alone form the unifying principle of our verse.

The latter theory is the orthodox doctrine of the grammarians

[8] "Introduction to English Prosody" (cited by Gayley and Scott).

[9] Essay appended to his Poems.

[10] "History of English Sounds," 1888, p. 102.

[11] "Grundriss der Englischen Metrik," 1895; "Englische Metrik," 1881–8.

[12] Preface to "Paradise Lost."

[13] "Life and Letters," p. 347.

[14] "Handbook of Poetics for Students of English Verse," 1888.

[15] *Cf.* Gayley and Scott for further bibliography along this line.

and of the common people, in spite of the insistence on time proportions, which we have seen, by an intellectual minority. The ordinary scansion of our verse rests upon regular alternation of accented and unaccented syllables or of "syllables differing in quantity" (Gould Brown). The emphasis here is on the regularity of the alternation. Most of us have had painful experience of this sort of scansion and no further description is desirable. Much of our best poetry is faultless in regard to such regularity.

On the other hand a great deal of verse does not show any appreciable attempt at such regularity. It is said that Tennyson read his own verse very musically and with regard to quantity. Such a poet would be inclined to disregard alternation of syllables, since he had another principle of unity upon which to fall back. Pope's verse is ideal for alternating accent and there is a prophecy of the place he was destined to occupy in future discussion in his deprecation of too much music in verse as analogous to the practise of attending church for the sake of the music.[16]

The commonplace seldom can have a genius for its advocate; the ordinary scansion is therefore left without any very articulate defense. Poe's caricature of it will serve as a starting point in order to make the distinction clear between his own position and that of Gould Brown who seems to have been selected as the scape-goat upon whom to cast the sins of all grammarians. Not only does Poe "deny the necessity of any *regularity* in the succession of the feet and by consequence the syllables, but disputes the essentiality of any *alternation* regular or irregular of syllables long or short." Compare this with Sweet's dictum that "the general tendency of the language is to alternate strong and weak stressed syllables as much as possible." Sweet (p. 31), however, agrees with Poe that mere alternation does not give rhythm without the additional element of regularity in time. But he considers that (p. 33) "emphasis, length, strong stress, and high pitch are naturally though not necessarily associated."

Ellis[17] finds some forty-five discernible degrees of accent or emphasis springing from various combinations of "force, length, pitch, weight and silence." His position is "that English verse, though based on alternation of force is naturally governed by length and pause, is seldom or never unaccompanied by variety of pitch unknown in prose and is more than all perhaps governed by weight."[18] The last named factor relates to the importance of the

[16] "Essay on Criticism," l. 337 ff.

[17] *Philolog. Soc. Trans.*, 1873.

[18] *Philolog. Soc. Trans.*, 1876.

ideas expressed and not to the loudness of the sound. It is not clear, however, whether weight is to be interpreted as a purely psychological element in the rhythm or whether its presence can be detected by some other alteration in the speech than those of force, pitch, length and pause.

Over against this school of compromisers stands Skeat[19] with the flat statement "that English poetry depends wholly on accent and can only be studied by considering the effects of accent." For him accent and length are distinct things and their frequent association in the same syllable are incidental matters. That there is no necessary connection between accentuation and duration is also held by Gurney,[20] and he holds further that an accented syllable may occupy a smaller part of the time space between ictus and ictus.

Inasmuch as the last named authority still clings to the notion that verse is rhythmical in the sense of being "metrical" it follows for him that rhythm is not latent in speech but imposed from without (Chap. XIX). That is to say, the nature of the language does not make an even flow of words of the right duration; it is only by constraint that we get the right arrangement. This is an idea of some significance and quite in accord with Darwin's idea that music and metrical forms were developed before language in the history of the race. If, however, the Spencerian doctrine of the primacy of language is accepted, rhythm ought to arise directly in that material and there could be no necessity for ever forcing the material to fit the form. Perhaps a compromiser will say that only some words fit given rhythms and others have to be squeezed or stretched to get them in.

For Abbott and Seeley[21] the names of feet denote groups of accented and unaccented syllables without regard to quantity. Accent is equivalent to loud stress. The regularity of a verse depends upon its having the right number of accents, and in this respect Abbott finds most verses regular although it is sometimes necessary to throw the accent upon a weak monosyllable in order to make up the number.

In this connection Coleridge's expression[22] with regard to the meter of some of his poems is significant. "The meter of Christabel is not, strictly speaking, irregular though it may seem so for its being founded on a new principle, namely, that of counting in each line the accents, not the syllables. Though the latter may vary from

[19] *Philolog. Soc. Trans.*, 1895–8, p. 485.
[20] "The Power of Sound," 1880, p. 429.
[21] "English Lessons for English People," 1871.
[22] Preface to "Christabel," 1816.

seven to twelve yet in each line the accents will be found to be only four." This "new principle" though more new in form of expression than in actual practise was of great importance in the subsequent usage of the English poets of the nineteenth century. For us one of the most instructive things about the statement is not the "new principle" but the old with which it is contrasted. Nothing is said about regularity of time but it is assumed that regularity generally is found in the alternation of long (accented) and short (unaccented) syllables for that is what is meant by counting the syllables. For Coleridge and his friends the accent was the basis of both the old and the new principles. Nothing else was even thought of.

That the ordinary routine scansions will last as long as there are children and common people is the verdict of Mayor.[23] He is "in favor of scanning by feet" and attempts to put the ordinary accented feet of the grammars on a scientific basis; and if he does not succeed in his attempt to be scientific he at least makes a good bold stand in favor of the conventional English system. He thinks that we are in no danger of falling into the error of mistaking our "iambs," etc., for quantitative feet in the classical sense simply because English speaking people have no ear for quantity as distinct from accent. He refuses to recognize (p. 55) any given *time* for two syllables. On the other hand the *number* of syllables to a foot is limited to three unless slurring or elision takes place.

Gummere[24] maintains that the unit in verse is one accent together with one or more unaccented syllables—regularity rests in the number of light syllables. "In the Germanic languages and in nearly all modern poetry accent is made the principle of verse; we weigh our words, we ask how much force, not how much time they require" (p. 137). All this in spite of what has just been quoted above about the importance of time. The conclusion seems to be that equal time intervals are found but their significance is secondary.

Schipper accounts for both accented and metrical verse in English by the historical development of Anglo-Saxon and Norman and neo-classic forms side by side. The former strain gives the accentual type, the latter the metrical type, and in our contemporary verse we find both types side by side or fused into one verse. The accentual type, however, predominates.

Guest[25] is more radical and seems to feel that the intrusion of

[23] "Chapters on English Metre," 1886, p. 6.

[24] "Handbook of Poetics," p. 169.

[25] "A History of English Rhythms," 1838.

measured verse into the language must not be permitted under any circumstances. He says[26] (p. 108) that it has been "said that our English rhythms are governed by accent; I, moreover, believe this to be the *sole* principle that regulates them. Most of our modern writers on versification are of a different opinion. The time is occasionally of great importance to the beauty of a verse, but never an index of its rhythm." He believes that "the rhythms that depend on accent are independent of quantity in every living language from India westward." There is, however, generally a sharper tone (though this is not necessary either) and also a lengthening of the accented (louder) syllable due to the greater effort of enunciation. Genetically considered all the English verse forms spring from the original "sectional" verse of our ancestors according to Guest. As the sectioning of the line becomes more elaborate, and the arrangement of forms more variable we get the different types of modern rhythm; the accent always remains, however, the basis of the rhythmic structure. We get the well-known forms iambic, dactyllic, etc., according as the accent stands in the first, second or third position in the foot.

[26] Ed. Skeat, 1882.

CHAPTER V

Time Relations as Treated by the Experimentalists

Brücke[1] seems to have been the first to give experimental determinations of the *Taktgleichheit* of verse. He asserts that "in German iambs and trochees it is not the quantity, not the alternation of long and short syllables, which holds together the rhythm but the repeated rising and falling of the accent at regular intervals" (p. 64). It is the interval between accents that really matters. The emphasis is thus kept on time relations but thrown off from the individual syllables on to the foot as a whole. There is a strong suspicion aroused that Brücke scanned his lines. Triplett and Sanford,[2] using a combined tapping and voice record, but relying on the tapping, found great regularity in the intervals between accents in nursery rhymes. The method has already been criticized. It probably accounts for the results. Hurst and McKay[3] got similar results, but in their case large variations were deliberately discarded; they never read naturally but always scanned. These two considerations invalidate the results as far as the present point is concerned.

Bolton[4] says, "In order for vocal utterances to form a rhythmic series, they must occur at regular intervals of time which can not exceed or fall much below certain limits." The different intensities, however, give unity to the series. The above statement has no experimental grounds. Squire[5] (p. 541) says, "Temporalness in its connotation of regular succession is the basal principle of rhythm." However, changes of intensity can also produce a rhythm in a regular time series. The doctrine here seems to be that there must be regularity in time first and that the grouping may be caused by temporal or accentual variations of the regular series.

Wallin[6] (p. 32) says that "the question of the quantitative character of poetry or prose, is closed. All speech is quantitative, and the distinction, popularly and confidently posited between quantitative and non-quantitative verse is grounded upon fallacious assumptions." His experiments give no warrant for such a gratu-

[1] "Die physiologischen Grundlagen der neuhochdeutschen Verskunst."
[2] *American Journal of Psychology*, **12**, 1901.
[3] *Toronto Studies*, **1**.
[4] *American Journal of Psychology*, **6**, 157, 1893.
[5] *American Journal of Psychology*, **12**, 1901.
[6] *Yale Studies*, **9**.

itous attack upon a distinction which is founded upon no assumptions whatever. Of course, no one in his senses ever doubted that speech is quantitative but there has been grave doubt whether quantity in speech gives rise to the rhythm of verse. So far as Wallin's results show anything at all on this point they indicate that quantity is not responsible for the phenomena of rhythm. "The regularity of the intervals in a given set of records of English poetry, the intervals of which are mostly of the two syllable type, and the scansion of which is rhythmically free was about 3 per cent. higher than the corresponding set of records of English prose, the reading of which is rhythmically free (32 per cent. of variation in this case). When the scansion or reading is natural, artistic and rhythmically free the complex centroid intervals are only slightly more regular in poetry than in prose" (pp. 118, 119). But certainly poetry is more rhythmical than prose. No reasons are given why the changes in quantity within a line, so far as they have any meaning at all and are not simply natural differences in time value of the sounds, should not be regarded as concomitants of the accent rather than as themselves determining the rhythm. The centroid system advocated by Wallin or Scripture is likable and sensible, but to try to graft it onto the older time or music theory of verse rhythm is equivalent to abandoning it altogether. Wallin himself seems to recognize this when he says (p. 113), "nor are centroid intervals to be conceived as a succession of bars of invariable length, nor as feet of similar length, nor as successive quanta of time conforming to an invariable measure." The centroid system of Wallin and Scripture is the equivalent of the section plan of the metrists and of the system of monopressures, if I understand the latter.[7]

The centroid is really an accented, or as some would call it, a weighted syllable. Its marks of differentiation are increased loudness, duration and heightened pitch. Wallin assumes that of these duration is the essential one, but he gives no reason for saying so and certainly the more obvious one is the increased loudness. Such a centroid is, in the simplest terms, a part of the sound series marked by one stress maximum. As used by Wallin the analysis of verse into such elements leaves no essential distinction between prose and verse. According to the arrangements printed by Scripture[8] for certain verses of poetry there is nothing left corresponding to a rhythm pattern for the verse. When tables are printed giving only the average number of syllables per centroid, or the average time

[7] Cf. Skeat, *Philolog. Soc. Trans.*, 1895–8. Only a few syllables can be pronounced on one breath pressure and this group is made the rhythmic unit.

[8] "Elements."

value of a centroid group, the only possible data for the analysis into rhythmic constituents are obscured. Surely rhythm consists of something more than the mere succession of these groups at more or less regular intervals of time. Are we to say that all rhythms are the same, both prose and verse—just this simple succession? Such an answer would be far from satisfactory; the centroid theory must develop a more thorough-going explanation of the phenomena which make one rhythm different from another before it can be considered as anything more than a way of summarizing certain observations which do not reach to the details. Inasmuch, however, as the centroid theory gets beyond the notion that there is no rhythm without extreme regularity of time relations it marks an immense step in advance.

Brücke, Bolton, Squire and McDougall recognize an effect of intensity (or accent in some form) only as a subsidiary factor entering in where there is already a uniform time series. Squire[9] and McDougall[10] even conceive of a rhythm without any accentual or at least without an intensive variety whatever.

Meumann considers time and intensity as compensating factors, either of which may take the place of the other. Just what this means for verse rhythm in view of the very regular association of the two in one syllable is hard to understand. There is no experimental evidence that a stressed syllable when short in time is correspondingly more intense. What evidence there is points just the other way.

The apparatus adopted in the present investigation is not designed to measure intensities nor have I been particularly concerned with the question of their measurement. Even if we had a complete plot showing the absolute and relative intensities of all the sounds of any given series of words or for any given verse, the question of the final basis of verse rhythm would be no nearer solved than it is to-day. We now know that intensities are there and we know their serial order. It is the times by which they are separated which we do not know and it is these that we must be able to describe if we are going to give a full account of the conditions under which the particular rhythmic phenomena of verse arise.

The only point with regard to the intensities in verse which it would help us to know about is their sequence in such a phrase as *pa ta pa'* or *pa' ta pa*. In such groups there appears to be a certain hierarchy of intensities. Similarly in such a line as *papa' papa' papa' papa'* such a hierarchy seems to exist, the second accented

[9] *Amer. Jour. of Psychol.*, **12**, 509, 541, 1901.
[10] *Psychol. Rev.*, **9**, 461, 1902.

syllable being stronger or heavier than the first. But these are questions of the detail differences of particular rhythm figures. To answer this is to tell nothing of the relative importance of duration and stress. Such questions will have to be answered if it turns out in the end that stress differences of this minor sort are the only differences that can be found between rhythms of different types or figures; meanwhile such details may be left aside while the other possible differences of the patterns are being examined.

CHAPTER VI

Experimental Results

(*a*) *Procedure*

The technique of the experiments has already been indicated in describing the apparatus. The subject was asked to recite the verses naturally and at the same time distinctly. None of the subjects[1] found anything in the conditions of the experiment to prevent doing this. In the case of nonsense syllables, which were always

TABLE I

The Iambic Tetrameter, *Papa' papa' papa' papa'*. At the left the reader and the number of his readings. Under "Pa," the average time value[2] of the first syllable of each foot. Under "V," the mean variation per cent.[3] Under "pa'," the second syllable. Under "foot," the average time of the foot. Under "ratio," the average quotient of the accented divided by the unaccented syllable.

W 54	Pa	V	pa'	V	Foot	V	Ratio	V
1st foot	20	*9.6*	57	*8.0*	77	*7.1*	2.9	*8.1*
2d foot	20	*9.6*	58	*7.3*	78	*7.0*	2.9	*9.1*
3d foot	20	*8.7*	57	*7.6*	77	*7.2*	2.9	*9.0*
4th foot	20	*9.7*	101	*21.2*	121			
H 41								
1st foot	25	*6.5*	52	*4.7*	77	*3.8*	2.1	*9.4*
2d foot	23	*6.7*	51	*5.1*	75	*3.7*	2.3	*9.2*
3d foot	24	*5.5*	49	*4.4*	73	*3.2*	2.1	*6.7*
4th foot	23	*5.9*	93	*6.5*	115			
F 73								
1st foot	18	*9.0*	36	*5.0*	55	*4.4*	2.0	*9.8*
2d foot	16	*8.1*	36	*5.3*	52	*4.9*	2.2	*8.5*
3d foot	16	*6.5*	36	*6.5*	52	*6.4*	2.3	*7.5*
4th foot	17	*6.3*	71	*9.5*	88			
B 48								
1st foot	20	*7.0*	53	*4.4*	73	*3.4*	2.7	*8.5*
2d foot	21	*6.9*	55	*4.4*	75	*4.3*	2.7	*7.6*
3d foot	21	*4.9*	52	*5.0*	73	*3.5*	2.5	*7.0*
4th foot	22	*6.4*	127	*12.4*	149			

[1] The readers in these experiments were: W, Dr. F. L. Wells, then Lecturer in Barnard College; R, A. E. Rejall, graduate student in psychology; L, D. O. Lyon, graduate student in psychology; H, H. L. Hollingworth, then Assistant in Psychology; F, S. Froeberg, sometime Assistant in Psychology; B, the author.

[2] The time is given, in all the tables, in hundredths of a second.

[3] In all the tables, the columns headed "V" give the mean variation expressed as a per cent. of the total time.

TABLE II

THE TROCHAIC TETRAMETER, *pa'pa pa'pa pa'pa pa'pa.* Under Pa' the first (accented) syllable. Under pa the second (unaccented) syllable. Otherwise the columns correspond to Table I.

W 46	Pa'	V	pa	V	Foot	V	Ratio	V
1st foot	22	*5.6*	48	*6.4*	71	*4.9*	.45	*8.4*
2d foot	22	*5.4*	51	*6.4*	73	*4.7*	.44	*8.2*
3d foot	22	*5.5*	49	*7.0*	72	*5.4*	.46	*8.6*
4th foot	22	*7.3*	88	*18.3*	110			
H 47								
1st foot	34	*6.0*	33	*4.6*	67	*4.2*	1.03	*7.1*
2d foot	34	*4.5*	33	*4.1*	67	*3.2*	1.02	*6.7*
3d foot	34	*4.8*	33	*5.7*	67	*4.4*	1.04	*7.4*
4th foot	35	*4.9*	99	*9.7*	133			
F 40								
1st foot	26	*5.9*	33	*5.7*	59	*3.8*	.78	*7.8*
2d foot	25	*6.0*	31	*6.3*	56	*4.0*	.81	*9.4*
3d foot	26	*5.1*	31	*5.0*	57	*2.9*	.86	*8.6*
4th foot	25	*6.0*	67	*9.6*	92			
B 50								
1st foot	28	*7.0*	32	*6.9*	60	*4.8*	.88	*9.6*
2d foot	28	*7.7*	32	*6.8*	60	*5.4*	.90	*9.1*
3d foot	28	*8.1*	32	*7.2*	60	*5.1*	.87	*11.3*
4th foot	28	*7.6*	102	*10.6*	130			

read as lines of verse, the reading was interrupted after each complete revolution of the drum. In other cases the reading was continuous for a longer period. The material consisted of nonsense syllables in tetrameter lines of different rhythms and of specimen bits of well-known English poems. This latter material was selected first on the ground of its familiarity and second on the ground of the possession of consonant combinations which could be most readily read from the record. No attempt was made to cover the entire field of English rhythm; in fact the verses chosen are almost all tetrameters. It is well to have them as comparable as possible with each other and the tetrameter is the most frequent meter in our non-heroic verse.

Having determined the beginnings of all the words and syllables in any record the durations of these were measured from the beginning of one to the beginning of the next. The validity of this procedure has been discussed above. Even if the record permitted of an exact determination of the end of any sound, which it seldom does, I am convinced that we ought still to count any gap which may occur between two sounds as being a prolongation of the preceding sound. Such a gap can not be excluded from the rhythm

TABLE III

THE ANAPESTIC TETRAMETER, *Patapa' patapa' patapa' patapa'*. The column headings are on the plan of Table I. The ratios are indicated by the sign of division. Only in the third foot were all the syllables measured.

W 30	Pa	V	ta	V	Pa+ta	V	ta/Pa	V	pa′	V	Foot	V	pa/(Pa+ta)	V	pa′/pa	V
1st foot					25	*7.3*			47	*5.2*	72	*3.6*	2.0			
2d foot					27	*6.2*			48	*5.4*	75	*4.4*	1.8			
3d foot	10	*7.1*	16	*7.5*	26	*6.4*	1.6	*9.2*	48	*5.8*	74	*4.8*	1.8	*8.3*	4.7	*9.0*
4th foot					27	*6.5*			97	*14.2*	124					
H 30																
1st foot	16	7.7	16	*10.3*	32	*6.7*	1.1		53	*5.9*	86	*4.1*	1.7			
2d foot	15	*8.9*	17	*9.3*	32	*4.8*	1.1		53	*5.4*	86	*3.9*	1.7			
3d foot	16	*9.9*	17	*8.3*	33	*5.5*	1.2	*14.5*	53	*4.6*	86	*3.5*	1.6	*7.3*	3.5	*11.3*
4th foot	15		17		32	*5.0*	1.2		92	*5.8*	109					
F 30																
1st foot					25	*7.2*			39	*3.8*	64	*4.3*	1.6			
2d foot					26	*5.2*			37	*4.3*	63	*3.8*	1.5			
3d foot	09	*9.2*	17	*10.2*	25	*6.8*	2.0	*14.0*	37	*4.4*	62	*3.2*	1.5	*9.2*	4.3	*10.9*
4th foot					25	*7.5*			72	*6.6*	97					
B 30																
1st foot					22	*7.3*			37	*4.8*	60	*3.5*	1.7			
2d foot					22	*5.7*			39	*3.5*	61	*3.0*	1.7			
3d foot	09	*10.8*	14	*9.2*	23	*7.4*	1.5	*14.9*	36	*5.1*	59	*4.3*	1.6	*10.4*	4.1	*11.9*
4th foot					24	*6.9*			108	*10.5*	132					

TABLE IV

THE DACTYLIC TETRAMETER, *Pa'tapa pa'tapa pa'tapa pa'tapa.* The column headings have the same meanings as in Table III.

W 30	Pa'	V	ta	V	Pa'+ta	V	Pa'/ta	V	pa	V	Foot	V	(Pa+ta)/pa	V	Pa'/pa	V
1st foot					20	*6.4*			43	*5.5*	64	*4.2*	.48			
2d foot					21	*4.9*			43	*7.1*	64	*4.7*	.49			
3d foot	07	*8.7*	14	*7.0*	21	*6.1*	.54	*9.1*	42	*5.8*	63	*4.0*	.51	*9.3*	.18	*11.7*
4th foot					21	*7.0*			73	*15.0*	98					
H 46																
1st foot					35	*5.1*			55	*5.3*	89	*4.0*	.63			
2d foot					34	*4.8*			55	*5.6*	89	*3.3*	.63			
3d foot	17	*8.4*	17	*8.7*	34	*5.5*	1.06	*11.9*	52	*6.0*	86	*4.0*	.67	*9.5*	.35	*11.6*
4th foot					35	*5.1*			98	*10.1*	133					
F 30																
1st foot					25	*6.2*			33	*5.0*	58	*4.0*	.75			
2d foot					25	*5.5*			33	*6.8*	57	*4.4*	.75			
3d foot	11	*9.0*	14	*7.7*	26	*4.8*	.80	*13.0*	32	*5.5*	58	*3.1*	.81	*8.6*	.36	*11.5*
4th foot					25	*5.9*			63	*9.5*	88					
B 30																
1st foot					25	*4.1*			32	*8.5*	57	*4.5*	.79			
2d foot					25	*4.5*			32	*8.7*	57	*4.0*	.81			
3d foot	10	*10.6*	17	*6.6*	27	*4.8*	.61	*13.3*	33	*7.7*	60	*4.1*	.82	*9.2*	.31	*12.7*
4th foot					26	*5.8*			114	*6.3*	140					

TABLE V

THE TETRAMETER LINE, *Oh pa'pa pa'pa pa'pa pa'*. At the bottom the first "pa" is combined with the second "pa'" as an iamb.

W 40	Oh	V	Pa'	V	pa	V	Foot	V	Ratio	V
Oh pa' pa	25	*9.8*	17	*5.9*	17	*5.6*	34	*4.5*	1.04	*7.1*
pa' pa			17	*6.0*	17	*5.8*	35	*5.2*	1.03	*6.2*
pa' pa			18	*5.9*	17	*5.7*	35	*4.8*	1.05	*6.9*
pa'			168	*19.0*						
pa pa'							34	*5.3*	1.07	*6.2*
H 44										
Oh Pa' pa	27	*5.9*	26	*6.9*	41	*6.2*	67	*4.2*	.64	*10.9*
pa' pa			25	*5.8*	40	*6.6*	66	*3.9*	.62	*9.6*
pa' pa			26	*7.2*	41	*6.0*	66	*3.5*	.62	*12.0*
pa'			102	*15.0*						
pa pa'							67	*3.6*	.63	*10.7*
F 40										
Oh Pa' pa	32	*7.9*	22	*7.9*	24	*7.2*	46	*4.5*	.93	*12.6*
pa' pa			23	*6.9*	24	*9.1*	47	*4.7*	.94	*12.4*
pa' pa			23	*7.9*	27	*7.3*	49	*5.2*	.86	*11.3*
pa'			62	*8.3*						
pa pa'							46	*3.6*	.95	*12.0*
B 40										
Oh Pa' pa	27	*8.3*	34	*6.4*	19	*10.7*	54	*4.7*	1.8	*11.8*
pa' pa			34	*8.4*	18	*12.2*	53	*4.8*	1.9	*17.4*
pa' pa			34	*6.0*	19	*8.3*	53	*3.5*	1.8	*12.1*
pa'			109	*8.5*						
pa pa'							53	*4.4*	1.8	*16.0*

altogether and certainly it does not seem sensible to call it part of a succeeding sound. In the case of the pause at the end of a verse or couplet I have made no attempt, as a rule, to separate the last syllable and the pause proper. As a consequence the final syllable does not enter into my calculations. If the verse is read as "run on" into the next verse this last pause is significant; if the verse is read as closing a stanza or as the end of a sentence the pause at the end has little or no meaning. I have contrived in nearly every case to avoid such dead endings by having the subject read another verse or two which was not counted. The nonsense verses were read one after another as if they made a long stanza. The pauses therefore are true verse pauses.

(*b*) *Duration of Feet*

One of the first places to look for that regularity which is supposed to characterize rhythm is in the time value of the "foot," or verse unit. The question here is, is one foot in a verse of approximately the same duration as another, or is the presence of such equality only accidental in some verses, others not showing it?

The force of an analogy with music is, of course, dependent upon the presence of such equality between the feet considered as measures. The facts which bear upon this point will be found in the tables under the heading "Foot." Glancing through Tables I.

TABLE VI

THE EFFECT OF CHANGING THE SYLLABLES IN IAMBIC TETRAMETERS. Records for two readings; the first day's reading above, the second below.

W	Cases		Pa	V	pa'r	V	Foot	V	Ratio	V
1st foot	14	1st day	17	*3.8*	75	*5.4*	92	*4.5*	4.4	*6.1*
	17	2d day	18	*6.4*	79	*3.6*	97	*4.7*	4.3	*4.2*
2d foot		1st day	17	*6.3*	77	*3.6*	93	*3.5*	4.7	*7.0*
		2d day	18	*3.5*	80	*5.0*	97	*4.5*	4.3	*4.1*
3d foot		1st day	16	*4.2*	77	*5.6*	93	*4.7*	4.9	*6.6*
		2d day	18	*5.1*	77	*6.3*	96	*5.5*	4.3	*8.1*
4th foot		1st day	16	*7.6*	116	*6.6*	132			
		2d day	17	*4.2*	129	*11.0*	146			
W					pa'rs					
1st foot	15	1st day	17	*4.1*	65	*5.2*	83	*3.8*	3.8	*8.0*
	17	2d day	19	*6.0*	68	*4.1*	87	*3.7*	3.6	*5.7*
2d foot		1st day	17	*6.6*	67	*5.5*	84	*5.3*	3.9	*5.3*
		2d day	18	*3.8*	71	*2.9*	89	*2.8*	3.9	*4.5*
3d foot		1st day	17	*3.6*	65	*7.0*	81	*4.6*	3.8	*6.9*
		2d day	18	*6.6*	68	*2.8*	87	*2.7*	3.8	*5.1*
4th foot		1st day	17	*4.3*	124	*12.1*	141			
		2d day	18	*5.5*	158	*14.1*	177			
W					pa'rst					
1st foot	13	1st day	17	*4.7*	65	*5.3*	83	*5.2*	4.0	*5.5*
	13	2d day	18	*6.4*	76	*4.5*	93	*4.3*	4.2	*6.4*
2d foot		1st day	18	*5.2*	67	*5.4*	84	*4.0*	3.8	*7.7*
		2d day	18	*5.5*	77	*3.7*	95	*3.6*	4.4	*4.9*
3d foot		1st day	17	*8.7*	64	*6.6*	80	*5.6*	3.8	*9.5*
		2d day	18	*4.1*	76	*4.8*	93	*4.0*	4.3	*5.7*
4th foot		1st day	17	*5.1*	119	*20.3*	136			
		2d day	18	*5.8*	143	*23.0*	161			

to IX., it is evident that the nonsense feet are very regular for each of the four subjects in each of the five rhythms examined. There are minor exceptions as, for instance, in Table I., Subject H, shows a slight acceleration in his reading from the first to the third foot. The low variation of his readings here makes it quite impossible that this should be the result of chance.[4] But on the whole

[4] The variations are expressed throughout in the amount of the mean variation (A.D.) of the series per centum of the average reading. This gives a figure that can be used for the comparison of the variation of one series with that of another series which has a somewhat different average value. The reader should, however, be very cautious about making such comparisons. The "probable error" (P.E.) of one of these averages would be equal to the

TABLE VII

THE EFFECT OF CHANGING THE SYLLABLES IN IAMBIC TETRAMETERS

H 17	Pa	V	pa′	V	Foot	V	Ratio	V
1st foot	26	*6.9*	60	*3.4*	86	*3.5*	2.4	*8.1*
2d foot	26	*5.2*	59	*4.2*	85	*3.4*	2.3	*6.1*
3d foot	26	*4.9*	60	*4.3*	87	*3.7*	2.3	*6.9*
4th foot	27	*4.9*	133	*7.2*	161			
H 33			pa′r					
1st foot	27	*6.1*	63	*3.8*	89	*2.9*	2.3	*7.2*
2d foot	27	*6.0*	61	*3.3*	89	*2.8*	2.2	*6.2*
3d foot	27	*4.2*	61	*4.3*	89	*3.2*	2.2	*6.9*
4th foot	27	*4.7*	121	*9.0*	148			
H 32			pa′rs					
1st foot	26	*5.6*	68	*3.2*	95	*2.1*	2.6	*7.7*
2d foot	25	*5.1*	68	*3.2*	93	*2.4*	2.6	*6.7*
3d foot	26	*5.1*	67	*2.7*	93	*2.7*	2.5	*5.1*
4th foot	26	*5.0*	130	*8.4*	157			
H 34			pa′rst					
1st foot	27	*8.1*	67	*5.0*	94	*4.3*	2.5	*10.0*
2d foot	26	*5.5*	67	*3.7*	93	*2.8*	2.6	*7.2*
3d foot	26	*6.3*	67	*4.2*	93	*3.5*	2.6	*8.1*
4th foot	26	*4.2*	133	*7.5*	159			

the feet may be said to have equal duration in the nonsense verse. No such equality appears, however, in the examples of actual verse. Even in the most simple and regular cases when there can be no question raised as to the correctness of the scansion the irregularities are glaring.

In the case given in Table X., for instance, which can be put in this form:

Subject	I come	from haunts	of coot	and hern
H	70	66	54	4 6
R	62	82	58	10 14

where the figures represent the times for Subjects H and R respectively. Not only are the feet not by any means equal but the inequalities are not subject to the same tendency for the two readers.

mean variation (A.D.) divided by the square root of the number of cases. This can be obtained from the per cent. value given in the table by multiplying by the average reading and dividing by the square root of the number of cases. The number of cases is large in the case of the nonsense material, because the variability itself was under consideration. In the ordinary verse only an approximate average was required and only ten cases as a rule were taken. The apparent increase in accuracy from the greater number of cases is in fact negatived by a constant shift in the tempo of the reading so that fifty cases do not form as homogeneous a series as ten.

TABLE VIII

THE EFFECT OF CHANGING THE SYLLABLES IN IAMBIC TETRAMETERS—*Continued*

F 31	Pa	V	pa′	V	Foot	V	Ratio	V
1st foot	17	*10.4*	39	*5.4*	55	*4.7*	2.3	*10.6*
2d foot	17	*9.9*	38	*7.0*	55	*6.1*	2.3	*10.3*
3d foot	16	*10.4*	36	*5.5*	52	*5.2*	2.3	*11.4*
4th foot	16	*10.3*	61	*7.2*	77			
F 40			pa′r					
1st foot	16	*9.9*	48	*6.2*	65	*5.0*	3.1	*10.6*
2d foot	17	*6.2*	47	*5.9*	64	*5.5*	2.8	*8.1*
3d foot	16	*7.5*	47	*5.6*	63	*4.7*	2.9	*8.5*
4th foot	16	*7.7*	69	*7.1*	85			
F 40			pa′rs					
1st foot	14	*7.4*	49	*8.7*	62	*7.1*	3.5	*9.9*
2d foot	14	*9.9*	49	*10.2*	63	*9.1*	3.4	*11.1*
3d foot	14	*9.2*	48	*8.3*	61	*7.4*	3.4	*10.8*
4th foot	14	*9.5*	73	*6.9*	87			
F 41			pa′rst					
1st foot	14	*10.2*	48	*7.4*	63	*6.8*	3.5	*13.4*
2d foot	14	*9.5*	47	*6.6*	61	*5.8*	3.4	*10.6*
3d foot	14	*10.5*	47	*6.8*	60	*6.7*	3.5	*10.8*
4th foot	14	*11.0*	73	*6.5*	87			

TABLE IX

THE EFFECT OF CHANGING THE SYLLABLES IN IAMBIC TETRAMETERS—*Continued*

B 23	Pa	V	pa′	V	Foot	V	Ratio	V
1st foot	18	*5.5*	40	*6.7*	58	*4.8*	2.3	*10.7*
2d foot	18	*8.0*	41	*4.5*	60	*4.2*	2.3	*9.7*
3d foot	18	*6.7*	40	*6.8*	57	*5.1*	2.2	*10.4*
4th foot	19	*7.0*	116	*9.0*	135			
B 40			pa′r					
1st foot	17	*6.0*	44	*4.9*	61	*3.2*	2.6	*9.5*
2d foot	17	*4.8*	44	*4.6*	61	*3.7*	2.6	*5.7*
3d foot	17	*5.5*	44	*4.1*	61	*3.0*	2.5	*7.4*
4th foot	18	*5.3*	121	*5.2*	139			
B 39			pa′rs					
1st foot	16	*5.7*	48	*6.3*	64	*4.2*	3.0	*11.1*
2d foot	16	*4.6*	49	*5.3*	64	*3.7*	3.1	*8.3*
3d foot	16	*4.6*	49	*4.9*	64	*3.4*	3.1	*7.2*
4th foot	16	*5.0*	124	*6.6*	140			
B 40			pa′rst					
1st foot	16	*5.2*	53	*7.5*	67	*6.4*	3.4	*9.0*
2d foot	16	*5.9*	53	*7.6*	69	*6.5*	3.5	*7.0*
3d foot	15	*5.1*	53	*7.2*	69	*5.5*	3.5	*9.0*
4th foot	16	*5.8*	127	*6.0*	143			

TABLE XA

AVERAGES OF 10 READINGS BY H OF THE VERSE, *I come from haunts of coot and hern.* Under "a" and "b," the unaccented and accented syllables respectively.

a	b′	a	V	b′	V	Foot	V	b′/a	V	b′/a[5]	V
I	come	38	*4.2*	32	*10.1*	70	*5.5*	.84	*12.2*	1.3	*9.1*
from	haunts	24	*9.5*	41	*6.1*	66	*4.7*	1.74	*13.8*	1.5	*8.7*
of	coot	28	*8.6*	26	*8.1*	54	*4.7*	.93	*12.9*	1.6	*14.8*
and	hern	16	*11.1*	101	*4.4*	117					
	Verse					307					
	Next verse					274	*3.9*				

[5] *Come* divided by *from*, etc.

TABLE XB

AVERAGES OF 10 READINGS BY R OF THE SAME VERSE

a	b′	a	V	b′	V	Foot	V	b′/a	V
I	come	32	*10.8*	30	*9.8*	62	*5.7*	.93	*14.8*
from	haunts	30	*9.0*	52	*4.8*	82	*5.9*	1.74	*7.2*
of	coot	22	*8.5*	36	*7.0*	58	*4.8*	1.63	*12.7*
and	hern	20	*8.5*	54	*11.8*	74			
	Verse					276			
	Next verse					246	*4.9*		

TABLE XIA

AVERAGES OF 10 READINGS BY H OF THE VERSE, *The stag at eve had drunk his fill*

a	b′	a	V	b′	V	Foot	V	Ratio	V
The	stag	19	*8.3*	46	*5.2*	65	*4.5*	2.4	*9.3*
at	eve	13	*14.8*	40	*4.0*	53	*5.7*	3.2	*18.2*
had	drunk	18	*8.6*	41	*2.6*	59	*3.2*	2.4	*10.3*
his	fill	28	*9.3*	106	*5.9*	134			
	Verse					311			

TABLE XIB

AVERAGES OF 10 READINGS BY R OF THE SAME VERSE

a	b′	a	V	b′	V	Foot	V	b/a	V
The	stag	19	*16.0*	47	*8.0*	67	*7.2*	2.6	*16.0*
at	eve	19	*8.8*	41	*7.6*	60	*6.7*	2.1	*9.0*
had	drunk	38	*8.7*	32	*6.2*	70	*5.0*	.85	*10.0*
his	fill	24	*11.1*	63	*9.2*	87			
	Verse					284			
	Next verse					313	*4.8*		

Any of the other verses will serve to bring out the same fact. Only one case (Table XI.).

Subject	The stag	at eve	had drunk	his fill
H	65	53	59	
R	67	60	70	

shows anything like the regularity which occurs in the case of the

nonsense verses. Other selections are not so regular in form and the scansion is open to some question. In some cases no attempt has been made to scan the verse and the reader is left to exercise his own ingenuity if he thinks that he can find any combination making uniform feet in a verse with separate syllables, such as those, for instance, of the second half of Table XII.

TABLE XII

AVERAGES OF 10 READINGS BY L. The time of each syllable is below it and below that the mv. per cent.

Al	most	u	pon	the	wes	tern	wave	Verse
22	34	11	26	11	28	15	48	195
9.0	*8.8*	*13.0*	*18.0*	*10.0*	*20.0*	*7.0*	*9.6*	
Res	ted	the	broad	bright	sun			
28	20	13	37	20	89			207
22.0	*19.0*	*15.0*	*9.5*	*19.0*	*6.5*			
When	that	strange	shape	drove	sud	den	ly	
21	16	45	46	28	28	11	36	194
9.0	*17.0*	*12.0*	*12.0*	*8.6*	*8.0*	*13.0*	*21.0*	
Be	twixt	us	and	the	sun	*Pause*		
17	28	27	27	12	40	99		250
9.4	*8.4*	*9.6*	*14.0*	*16.0*	*6.7*	*14.0*		

But such puzzles as this excepted a perusal of the tables will convince anyone that there are divisions corresponding pretty closely to the conventional feet and having somewhat the same duration even though there is nothing that could be called equality between them. Such an example as the nursery rime "Pease porridge

TABLE XIII

THE AVERAGE TIME FOR VERSE AND THIRD FOOT FOR EACH OF FOUR READERS IN EACH RHYTHM

	W		H		F		B	
	Verse	3d Foot	Verse	3d Foot	Verse	3d Foot	Verse	3d Foot
Pa pa′			419	87	238	52	310	57
Pa pa′r	436	96	450	89	277	63	322	61
Pa pa′rs	440	87	438	93	273	61	332	64
Pa pa′rst	442	93	438	93	271	60	348	69
Pa pa′	353	77	340	73	247	52	370	73
Pa′ pa	326	72	334	67	264	57	310	60
Oh pa′ pa	297	35	328	66	236	49	296	53
Pa ta pa′	345	74	367	86	286	62	312	59
Pa′ ta pa	289	63	397	86	261	58	264	60
Average	366	75	386	82	264	58	319	62

TABLE XIV

AVERAGES OF 26 READINGS BY H OF *Pease porridge hot*, etc.

a	b	c	a	V	b	V	a+b	V	c	V	a+b+c	V	2 Phrases	V	4 Phrases	V
Pease	porridge	hot	49	*8.9*	38	*8.7*	87	*8.7*	113	*6.4*	200	*5.5*				
pease	porridge	cold	48	*7.1*	52	*8.3*	100	*7.6*	106	*4.4*	206	*5.1*	406	*5.3*		
pease	porridge (in the pot)[6]		49	*8.2*	46	*8.3*	95	*6.8*	91	*5.9*	185	*6.1*				
nine	days	old	57	*12.1*	46	*8.4*	103	*9.8*	116	*13.9*	220	*11.3*	405	*8.7*	810	*6.8*

[6] *in* = .26 sec. (V, *12.8%*) ; *the* = .17 sec. (V, *11%*) ; *pot* = .48 sec. (V, *8.7%*).

TABLE XV

AVERAGES OF 10 READINGS BY H OF *Break, break, break*, etc.

a	b	c′	a	V	b	V	a+b	V	c′	V	a+b+c	V	Pause	V	Phrase	V
		Break							82	*6.6*	82	*6.6*				
		break							75	*6.7*	75	*6.7*				
		break							85	*6.8*	85	*6.8*			241	*4.5*
On	thy	cold	19	*12.2*	35	*12.7*	54	*8.7*	65	*5.1*	119	*4.2*				
	gray	stones			41	*5.8*	41	*5.8*	84	*6.6*	125	*5.0*			244	*1.9*
	oh	sea			23	*6.8*	23	*6.8*	60	*4.0*	83	*3.4*	97	*12.8*	180	*6.8*
But	the	ten-	16	*8.5*	18	*2.2*	33	*3.9*	29	*5.9*	62	*3.4*				
	der	grace			25	*6.8*	25	*6.8*	49	*4.7*	73	*4.4*			135	*3.5*
of	a	day	12	*7.4*	24	*7.0*	36	*4.4*	32	*6.3*	68	*3.2*				
that	is	dead	11	*10.7*	31	*3.9*	42	*2.8*	78	*11.5*	120	*6.7*			189	*3.8*
will	ne′	ver	33	*10.4*	12	*11.3*	45	*7.1*	26	*6.2*	71	*6.0*				
	come	back			30	*7.0*	30	*7.0*	40	*6.1*	70	*5.6*			141	*4.6*
	to	me			13	*13.2*	13	*13.2*	47	*7.7*	60	*5.9*	163	*6.8*	223	*4.7*

hot'' which is cited by Poe as a verse having feet of equal duration, will serve to show how far there really is equality. The scansion is Poe's, the figures from Table XIV.

Pease	porridge	hot,	pease	porridge	cold,	
49	38	113	48	52	106	
Pease	porridge	in the	pot,	nine	days	old.
49	46	43	48	57	46	116

Taking account of the pauses the feet certainly maintain a pretty constant length (and this testifies to the accuracy of Poe's ear) but there is no real equality between them. The same thing can be seen in Table XV., where not even the three words *Break, break, break* occupy equal times, but where well-defined feet are in evidence.

In some cases such ''feet'' are only to be discovered by a violation of the conventional scansion. Table XVI. gives

Where twined	the path	in shadow	hid
89	82	79	

Here an extra syllable has to be borrowed by the third foot from the last and even then it is shorter than the others. Evidently mechanical scansion will not give feet of even approximately equal lengths. But if freer scansion does reveal such feet the question arises how much irregularity can be countenanced; that is, where ''regularity'' begins.

One experiment made upon Subject H, who can sing, throws some light on this question in so far as it reveals correspondingly large irregularities in the duration of musical notes. The results of reciting and singing the same words, ''Blow, blow, breathe and blow, Wind of the western sea,'' are summarized in Table XVII. The times are given for the syllables as read and as sung;[9] then the proportional time the notes should have in the song, and lastly, the time of the syllables as read increased to the tempo or rate at which they were sung. Both reading and singing have a different tempo for the two verses. It appears that in this case at any rate, the reading while regular as regards ''feet'' is no more so than singing without accompaniment.[10] Certain differences are noteworthy. The reading tends more to equalize the corresponding words *blow, blow.*

[9] The subject is thoroughly competent to sing this well-known song acceptably and he said that the apparatus did not hamper him.

[10] For the degree of regularity to be expected in musical performances see Binet and Courtier, *L'Année psychologique,* 1895.

TABLE XVI

AVERAGES OF 13 READINGS BY H OF *Where twined the path in shadow hid*

a	b′	a	V	b′	V	Foot	V	Ratio	V
Where	twined	43	*6.9*	46	*5.2*	89	*3.9*	1.1	*9.3*
the	path	18	*6.5*	64	*6.1*	82	*4.1*	3.6	*8.3*
in	shad	26	*11.5*	29	*5.6*	55	*5.5*	1.1	*14.8*
ow	hid	24	*11.5*	81	*7.0*	105			
Verse						331	*2.8*		

TABLE XVII

AVERAGES FOR H, 10 CASES READING AND 20 CASES SINGING, *Blow, blow, breathe and blow, Wind of the western sea*

	Beading Time	V	Singing Time	V	Singing[7] Time	Reading[8] Time	Measure Reading Time	V	Measure Singing Time	V
Blow	113	*7.6*	173	*7.3*	174	189	113	*7.6*	173	*7.3*
blow	116	*7.5*	188	*5.8*	175	194	116	*7.5*	188	*5.8*
breathe	51	*7.4*	113	*7.7*	131	86				
and	45	*6.7*	61	*11.0*	44	75	95	*5.7*	173	*5.5*
blow	92	*5.0*	164	*10.0*	174	154	92	*5.0*	164	*10.0*
Verse							416		698	
Wind	62	*10.0*	86	*11.0*						
of			62	*5.0*						
the	27	*5.0*	25	*16.0*			89	*7.8*	170	*9.7*
wes	38	*8.8*	113	*12.0*						
tern	31	*8.4*	46	*15.0*			70	*6.7*	158	*9.7*
sea	199	*4.7*	176	*10.0*					176	*10.0*
ea (2d measure)			112				199		112	
Verse							358		616	

The two words *breathe and* are sung in correct time, but are spoken too fast. The same is true of the two syllables of *western.* The general inference to be drawn from this table is that the lack of absolute equality in time between the feet does not mean that there are no feet, but rather that the changes due to introducing meaning and variety into the material tend to reduce very greatly the regularity.

That the time occupied by a foot is only in part dependent upon the number of consonants involved is seen in Tables VI. to IX. These records were so taken as to avoid interference from the tendency of the reader to change his rate of reading during the sitting. The individual differences of the readers are so large that it is not possible to say what the effect of adding any one consonant will be. Evidently it will not be great, and in some cases the time is actually shorter when the consonant group is more complex. The figures of Table XIII. again give an opportunity for rough com-

[7] Theoretical time for the notes on basis of total time of verse.

[8] Reading time magnified to same scale as singing time.

parison. The large individual differences undoubtedly depend in large part upon the way in which terminal *r* was pronounced.

In many cases the verse seems to be divided into short phrases rather than "feet" in the ordinary sense. "Pease porridge," Table XIV., is an example. Other examples are "Break, break," Table XV.; see also Tables XVIII., XIX. These phrases might be considered as the rhythmic elements in the verse, for they are fairly uniform in length while the feet are far less regular. Still more might the whole verses themselves be considered the units since they are still more uniform than the feet.

TABLE XVIII

AVERAGES OF 35 READINGS BY H OF *Each purple peak, each flinty spire Was bathed in floods of living fire*

a	b′	a	V	b′	V	Foot	V	Ratio	V	2 Feet	V	4 Feet	V
Each	pur	46	*9.1*	22	*7.2*	68	*6.2*	.48	*15.3*				
ple	peak	28	*8.9*	81	*6.7*	110	*4.9*			178	*4.4*		
each	flin	35	*7.7*	31	*8.3*	66	*5.8*	.88	*12.0*				
ty	spire	21	*7.5*	90	*7.3*	111	*6.8*			177	*5.0*	355	*3.9*
Was	bathed	42	*9.3*	46	*4.0*	88	*5.2*	1.13	*9.5*				
in	floods	17	*12.0*	53	*6.6*	70	*5.2*			159	*4.0*		
of living	fire									223	*6.0*	379	*4.5*

TABLE XIX

AVERAGES OF 10 READINGS BY H OF *Double, double, toil and trouble, Fire burn and caldron bubble*

a′	b	a′	V	b	V	Foot	V	Ratio	V	2 Feet	4 Feet
Dou	ble	23	*6.2*	51	*6.1*	73	*4.1*	.45	*9.4*		
dou	ble	21	*8.1*	61	*13.2*	81	*9.8*	.35	*13.3*	155	
toil	and	54	*6.4*	40	*9.8*	93	*6.6*	1.4	*9.0*		
trou	ble	26	*11.3*	79	*7.4*	105	*5.7*			198	*353*
Fire	?[11]	62	*7.9*			62	*7.9*				
burn	and	62	*12.2*	35	*10.5*	98	*8.9*	1.8	*17.7*	160	
cal	dron	41	*7.2*	39	*6.9*	81	*4.5*	1.07	*11.0*		
bub	ble	17	*4.4*	148	*4.7*	165				246	*406*

But there is a criterion of the "foot," or element, provided in the absolute time of the nonsense verse. There does exist in that material a unit of very definite form revealed by the most casual inspection of the voice record. This unit has rather narrow limits in point of absolute time value for any one reader. The average value of none of the first three feet in the tetrameters of Subject H, Table VII., is longer than .95 second or shorter than .85 second; and so for the other readers.

[11] The word *fire* seems to have two syllables here.

Since these well-defined units seem so essential to free spoken rhythms like the nonsense verse we are justified in looking for them in other verse as well. But in every case the longer phrases of which I have spoken differ from the "feet" of the nonsense verse in the very fact that they are longer. The phrases of "pease porridge," Table XIV., for instance, are about twice as long as the longest feet of the nonsense verse. It is fair to say, then, that whatever the significance[12] of these phrases they are not analogous to the "feet," in the strict sense, which appear in nonsense material and also in the simplest poetic verse. The absolute time for a foot for any one individual is determined partly by the rhythm and partly by the content, as can be seen by following down the columns of Table XIII. In different selections of actual verse the feet occupy times approximating the time of a foot in the same rhythm in nonsense verse. The minimum is above half a second and the maximum less than one second.

Closely connected with the matter of the duration of the feet is that of the rapidity of utterance as indicated by the time of a whole verse. Here we find very great individual differences. These come out most strikingly in the nonsense material. Table VIII., for example, shows Subject F going through identical material in only two thirds of the time occupied by Subject H. In Table XIII. the rates of different readers are shown in all the rhythms. It will be seen that each has a very regular characteristic tempo relative to the others, F being fastest and H slowest. The averages at the bottom give a rough measure of these personal peculiarities.[13]

(c) *Ratio of Accented to Unaccented Syllables*

The second place in which regularity is to be expected is in the ratio between the accented and unaccented parts of the foot. Here again we find very remarkable regularity in the case of the nonsense verse and even more remarkable irregularity in the case of the natural verse. The most generally significant fact is that each separate verse has its own ratios and each reader his own, so that while these ratios remain fairly well fixed for any one reading they

[12] I am inclined to hold that such clauses are to be interpreted as short verses. The length of a line on the printed page often obscures the true length of the verse, two actual verses being printed as one, or one divided in the middle. In the absence of a regular rime the determination of the true verse requires special investigation.

[13] This is not the place to discuss these results from the point of view of individual differences. They are probably parallel effects associated with rapidity of respiration and heart beat, all expressive of the general organic rate of the individual.

have no constant form. Thus in Table II. the ratios for different readers range from .45 to 1.[14]

In Table VIII. on the other hand the ratio (still remaining fairly constant for one set of material) changes from 2.3 to 3.5 with a change of material in the same rhythm.

These facts exclude at once the idea that there is any fixed relation between a "long" and a "short" syllable. Moreover when we turn to the natural verse we find that there is no trace of such a relation. Table XVIII., for instance, shows two exact reversals of normal condition in iambic verse. The "short" syllable is here twice as long as the corresponding "long" syllable. *Was* and *bathed* on the other hand are almost equal. Again, in Table XIX., *double* shows the accented and theoretically "long" syllable less than half as long as the "short" syllable. It is needless to multiply particular instances; the tables are full of them.

Tables VI. to IX. show the results of an experiment which is crucial upon this point. It amounts to this; when the character of the syllable is changed in any given rhythm there is a change of ratio of the parts. In Table IX. the effect of complicating the long syllable in iambic rhythm[15] is to lengthen the whole foot regularly. But at the same time the short syllable is shortened as if there were a tendency to make it compensate for the greater length of the other syllable. The result is a steady increase in the ratio of the parts along with the increase in total length of the foot. Table VIII. shows the same thing, save that the compensation is really effective in the lower half of the table so that the total length of the foot does not increase, but there is enough decrease in the first syllable to balance the increase in the second, and the ratio mounts rapidly. In Tables VI. and VII. the short syllable remains fairly constant and changes in the long one are reflected in a changed ratio. Without the evidence from the natural verse these tables

[14] By ratio is to be understood the figure got by dividing an accented by an unaccented syllable. The latter is then always unity and the figure given is the relative length of the accented syllable; this figure will be less than unity if the accented syllable (as sometimes happens) is not so long as the unaccented. The variations given with the ratios are per centum and are only to be used in comparing different ratios. They furnish no criterion for comparing the variability of ratios and of separate syllables or feet.

[15] Iambic rhythm offers the critical case for this phenomenon because the effect is seen in the short (first) syllable which is not directly affected by the changes in the other syllable. If trochaic rhythm were taken such a shortening of the unaccented syllable in response to a lengthening of the accented might be ascribed to a change in the length of the pause at the end of the foot. In the case of iambic the pause can not be connected in any way with the phenomenon.

offer complete proof that no "strict music" theory of verse will hold. The syllables do not behave like the notes in music. On the contrary they are inversely related; when one is long the other is short.

A change in the rate of reading does not seem to have any very regular influence on the ratio of the syllables. Table VI. shows the changes which occur when a subject reads the same material on different days. The differences both in tempo and ratio are large compared with the variation within either of the series. The records of *pa pa'* in Table I. may also be compared with Tables VII., VIII. and IX. taken on different days. The changes of tempo, as indicated in the summary below, are considerable in every case but the ratios show only a very slight tendency to increase as the rate becomes slower.

Subject	Time of Verse	Ratio
H	340	2.1
	419	2.3
F	247	2.3
	238	2.3
B	370	2.5
	310	2.2

Table XX. gives the result of a deliberate effort to change from the normal rate of reading to a faster rate. To the listener this gives a general impression of haste and the esthetic result is bad, nevertheless the reader managed to give more than thirty repetitions with an average variation of only 3 per cent. for the verse; his performance was practically as uniform at the rapid rate as when reading normally. His own impression was that the saving in time was made at the cost of certain slight logical pauses in the verse.

TABLE XX

THE VERSE, *She kept with care her beauties rare,* READ BY R 30 TIMES AT A NORMAL TEMPO, AND 30 TIMES IN HASTENED TEMPO

a	b'		a	V	b'	V	Foot	V	Ratio	V	Verse	V
She	kept	norm.	44	*9.1*	20	*4.9*	64	*6.4*	.47	*9.9*		
		hast.	32	*10.0*	18	*10.0*	49	*7.4*	.56	*14.0*		
with	care	norm.	40	*3.3*	58	*7.5*	98	*4.7*	1.4	*7.2*		
		hast.	32	*5.5*	42	*9.6*	74	*5.6*	1.3	*11.0*		
her	beau	norm.	37	*7.7*	23	*6.7*	60	*5.8*	.64	*9.6*		
		hast.	32	*7.2*	21	*4.6*	53	*4.1*	.66	*9.2*		
ties	rare	norm.	30	*10.0*	56	*7.5*	85	*4.9*			310	*2.9*
		hast.	25	*7.3*	38	*10.0*	63	*5.0*			240	*3.1*

The results show that this introspection is only partly valid. All the syllables are shortened and the ratios, which are themselves notably different from the accepted iambic scheme, remain practically the same. It appears, however, that the greater part of the shortening comes out of the long syllable whether it is accented or not and whether or not it includes a pause. Deliberately changing the tempo does not, then, serve to make any grave difference to the rhythmic structure nor to affect seriously its regularity.[16] There is, however, a slight change in the ratio of the syllables as was the case when different vocal complexes were tried in the same rhythm.

In view of the great variety of ratios which appear between the syllables of the different feet in even the most simple of the verses of poetry which have been examined it is remarkable that there is such great regularity between the different readings of the same verse. In other words, no matter how irregular the verse pattern, it is persistent, maintaining its form time after time. It is reasonable to suppose that this regularity is partly a function of the natural duration of the individual words which enter into the verse. It is not true, however, that the same words have the same time value in different verses.

(*d*) *Rising and Falling Rhythms*

A discussion of the ratio of the syllables in a foot naturally leads to a consideration of those particular time relations within the foot which constitute the character of a particular rhythm. And first of those; wherein do the rising rhythms with the accent on the last part differ from the falling rhythms with the accent at the beginning of the foot? Here again the distinction is clearest in nonsense material where the nature of the subject-matter exerts the least disturbing influence.

Table I. shows rising, Table II. falling rhythm with the same pair of syllables differently accented. In iambic (rising) rhythm the length of the long syllables is between two and three times that of the short (unaccented) syllable. In trochaic (falling) rhythm the accented syllable is shorter than the unaccented in every case but one. The ratios in the third foot[17] are, for the different subjects:

Subject	W	H	F	B
Iambic	2.9	2.1	2.3	2.5
Trochaic	.46	1.04	.86	.87

[16] See discussion of variabilities below.

[17] This foot is selected as typical because it is less subject to the disturbing effect of position. The first foot is likely to be irregular, the second and fourth are followed by pauses.

The reader, H, who has the least difference between the syllables in one rhythm has the least difference in the other, and the one who has the greatest difference in the one, W, has the greatest difference in the other. This being interpreted means that the second syllable was always relatively short for the one and long for the other. The ratio for iambic tends to be greater than the orthodox 2:1 of the theorists, while the ratio for the trochaic tends more to be 1:1. The individual differences are so great as to cause an overlapping of the two species. Thus the ratio of W, trochaic, is practically the reciprocal of that of H, iambic. Consequently it is not possible to draw a hard and fast line between the two rhythms on the basis of the time relations of the syllables alone.

The absolute times of the third foot as given in Tables I. and II. are:

Subject	W	H	F	B
Iambic	77	73	52	73
Trochaic	72	67	57	60

The tendency to acceleration in the trochaic rhythm is too small to be significant. Table V. shows what remarkable results can be got by what appears to be a very insignificant change in the rhythm. The introduction of a catch syllable at the beginning and the cutting off of the final unaccented syllable at the end of the verse gives a new tempo and new set of ratios to the whole verse. The time for verse and foot, Table XIII., is less for this form than for either trochaic or iambic. The ratio is not appreciably changed by coupling the second accented syllable with its succeeding (trochaic) or preceding (iambic) syllable. For corresponding third feet the ratios are:

Subject	W	H	F	B
Iambic	2.9	2.1	2.3	2.5
Intermediate form	1.05	.62	.86	1.8
Trochaic	.46	1.04	.86	.87

For F the rhythm is the same as trochaic. For W and B it is intermediate between trochaic and iambic. For H it is more trochaic than the natural trochee. A comparison of trochaic and iambic rhythms in actual verse is not easy, the chief reason being that their time relations are too much alike. "The boast of heraldy," Table XXI., and "The stag at eve," Table XI., are as regular as any of the iambic specimens. Table XXII. gives a trochee which may be said to be more trochaic than the nonsense type because in

TABLE XXI

AVERAGES OF 15 READINGS BY H OF *The boast of heraldry, the pomp of power*

a	b′	a	V	b′	V	Foot	V	Ratio	V
The	boast	17	*10.6*	46	*3.6*	63	*3.4*	2.8	*11.6*
of	her	16	*8.5*	45	*5.6*	61	*4.3*	2.9	*13.7*
	aldry					73			
The	pomp	18	*10.4*	42	*5.2*	60	*4.7*	2.5	*13.0*
of	power	29	*8.8*	92	*5.2*	120	*5.1*		
Verse						377	*2.4*		

TABLE XXII

AVERAGES OF 12 READINGS BY H OF *Sleep the sleep that knows no breaking*

a′	b	a	V	b	V	Foot	V	Ratio	V
Sleep	the	50	*2.9*	18	*14.0*	67	*4.5*	2.8	*17.0*
sleep	that	43	*8.8*	19	*11.0*	62	*7.3*	2.3	*11.0*
knows	no	49	*5.0*	46	*5.8*	94	*2.6*	1.1	*9.3*
brea	king	24	*4.2*	150	*8.7*	174			
Verse						397			

TABLE XXIII

AVERAGES OF 10 READINGS BY L OF *Wha will be a traitor knave, etc.*

a	b	a′	V	b	V	Foot	V	Ratio	V
Wha	will					68	*5.3*		
be	a					40	*10.0*		
trai	tor	23	*10.0*	19	*13.0*	43	*8.4*	1.3	*17.0*
knave						55	*11.0*		
Verse						206			
Wha	can	35	*14.0*	19	*19.0*	54	*12.0*	1.8	*19.0*
fill	a					59	*6.0*		
cow	ard's					54	*7.6*		
grave						76	*14.0*		
Verse						243			
Wha	so	34	*13.0*	35	*10.0*	69	*5.4*	.97	*19.0*
base	as	31	*7.2*	15	*15.0*	46	*7.4*	2.1	*14.0*
be	a					38	*8.5*		
slave						59	*11.0*		
Verse						212			
Let	him	24	*18.0*	38	*10.0*	62	*11.0*	.62	*14.0*
turn	and	38	*10.0*	20	*9.0*	58	*9.9*	1.9	*9.0*
flee						129	*13.0*		
Verse						249			

two of its feet the ratio of the syllables is more extreme. These two feet look more like inverted iambs. Table XXIII. shows great irregularities in respect to ratio in a verse which was selected as

typically trochaic. Parts of this record could not be deciphered with certainty. The tempo is fast, and the rhythm complex, with very unequal feet. Tables XVIII. and XIX. constitute final evidence of the indistinguishableness in regard to ratios of iambs and trochees. In the former those feet which are free from pauses are better trochees than iambs; in the latter true trochees give irregular results which would look quite as well interpreted as iambs.

The confusion of these two rhythms is caused by the fact that accent does not always carry with it an increase in duration, hence the ratios do not obey the accentual schemes.

In Table XXIV. we have what seems to be a specimen of the anomalous rhythm of Table VIII. Its tempo is somewhat faster

TABLE XXIV

TIME AND VARIATION OF SYLLABLES. H, 10 readings.

And	cu	ckoo	buds	of	yel	low	hue		Verse
40	19	28	54	19	22	24	80		286
14.0	*7.4*	*5.4*	*7.6*	*8.8*	*11.0*	*14.0*	*24.0*		
Do	paint	the	mea	dows	with	de	light	*Pause*	Verse
25	35	9	22	26	25	19	46	100	307
8.9	*5.7*	*10.0*	*10.0*	*9.2*	*11.0*	*6.8*	*8.5*	*4.5*	

TABLE XXV

TIME AND VARIATION OF SYLLABLES. H, 10 readings. Read with full stop at the end.

The	splen	dor	falls	on	cas	tle	walls	Verse
9	54	26	52	43	26	23	110	343
7.1	*7.9*	*6.4*	*6.6*	*7.5*	*8.1*	*13.6*	*7.8*	
And	snow	(y)[18]	sum	mits	old	in	story	Verse
23	55	—	26	59	47	19	185	414
14.2	*9.3*	—	*4.7*	*8.5*	*4.4*	*4.1*	*5.4*	

than the ordinary iamb of Table XXV. but except for the unexpected length of the unaccented initial syllable the internal structure shows no remarkable peculiarities. There is nothing to indicate whether the verse should be treated as trochaic or iambic. Both these specimens exemplify the chaotic time relations of verses which are quite respectable rhythmically.

(*e*) *2-Syllable and 3-Syllable Rhythms*

The number of syllables in a foot is one of the factors which distinguishes verse rhythms. The characteristics of the three-

[18] Can not be separated in the record from the preceding syllable.

syllable type are analyzed in Tables III. and IV. In respect to the time value of the foot and verse there is no marked difference between iambic (2-syllable) and anapæstic (3-syllable). The latter move faster for two of the readers and slower for the other two. Neither do the trochaic and dactylic forms show any constant difference in this respect. The relation of the ratios is complicated. Taking the point of view first that either of the short syllables in 3-syllable rhythm is analogous to the short syllable in 2-syllable rhythm we find the ratio between accented and unaccented much larger in anapæstic than in iambic. As a rule this means that the short syllable is much shorter in the former case while the long one is not correspondingly shorter. Dactylic rhythm yields a ratio much smaller than trochaic, due to the fact that the accented syllable is much shorter in the dactyl.

Now consider for a moment the two short syllables together as equivalent to the corresponding part in the 2-syllable rhythm. The anapæst then shows a ratio not unlike the iamb but smaller, for the two shorts of the anapæst are longer than the one of the iamb and its long is shorter. The dactyls yield a ratio almost exactly the same as that of their analog the trochee, for all of the readers except H. His ratios for the dactyl and for the trochee with an extra syllable, Table V., are the same practically, both differing from his simple trochee in the sense that the latter departs from the regular trochaic type of the other readers. That is, his trochee is the exception, not his dactyl. Considered in this way, no very clear line of distinction appears even in the nonsense verse between 2-syllable and 3-syllable rhythms.[19]

The distinction between the rising and falling rhythms is not so clear in the 3-syllable type as it is in the 2-syllable type. The rate is slightly faster in the dactyls than in the anapæsts.[20] The relation of the two short syllables is the same for dactyls as for anapæsts, the first being shorter whether accented or not. The last syllable is only very slightly longer when accented, consequently the relation between it and the initial syllable is practically the same for rising or falling rhythm. The ratio of the last syllable to the sum of the first two in the third foot is:

[19] An inspection of the voice records will bring out more clearly than the figures the fact that the two short members of the 3-syllable combination are so closely connected as to be almost inseparable while they are at the same time well marked off from the rest of the foot.

[20] For subject H the verse is somewhat slower in the dactyl, but the foot only very slightly so.

Subject	W	H	F	B
Dactyl	2	1.5	1.2	1.2
Anapæst	1.8	1.6	1.5	1.6

These particular differences exaggerate the general argument of the tables and still they are not sufficient to be significant. Neither in regard to tempo nor ratio are dactyls clearly distinguishable from anapæsts. The distinction must lie outside of the time relations of the elements in the verse.

The examination of the question in the case of actual verse is made very difficult by the disputes which immediately arise as to what verse is to be read as dactylic and what as anapæstic. On this account no attempt has been made to construe the feet of certain of the verses. In other cases the form is sufficiently well determined to warrant an interpretation. The distinction between the 2-syllable and the 3-syllable feet of the same, rising or falling, rhythm is one which is easier to draw. Table XXVI. presents a case where the comparison is made easy by the occurrence of the same words at the beginning of the two verses. The dactyl departs

TABLE XXVI

COMPARISON OF DACTYLS WITH TROCHEES. H, 15 readings; with full stop at the end.

Dactyls	Time	V	Trochees	Time	V
High	52	*10.1*	High	48	*8.0*
u-	21	*10.0*	u-	20	*8.7*
pon	29	*6.0*	pon	22	*6.4*
High-	35	*9.1*	a	18	*5.8*
lands	62	*6.7*	gol	32	*6.8*
and	18	*8.5*	den	26	*6.7*
low	43	*4.5*	throne	160	*7.8*
u-	20	*9.0*			
pon	41	*8.1*			
Tay	125	*4.5*			
Verse	446			326	

from the standard of the nonsense verse in that the accented syllable is comparatively long, while the final unaccented syllable is not proportionally so long. The trochee is not typical in that its first syllable is too long but after that the approximately equal length of the syllables is typical. The significant difference between the dactyl and the trochee lies in the greater length of the syllable *pon* in the former. This is evidently due to the pause which follows. That syllable in the trochee is initial in the foot and even with a very free reading bears an accent. The presence of this accent does

not, however, make it as long as the corresponding weak syllable at the end of the dactyl.

Table XV. shows at least three anapæsts which approximate the type given by the nonsense verse. The combination "Will never come back" can be scanned by the reader to suit himself; the point of chief interest is that the strongly accented syllable *ne* is very short in time, being a little over one third as long as the preceding unaccented *will*. This verse read as iambs (the two unaccented syllables counting as one) is quite as regular as it is taken any other way and quite as near the ordinary iamb as is, for instance, "I come from haunts," Table X.

TABLE XXVII

AVERAGES OF 10 READINGS BY H

Why	then	comes	in		Half verse	
34	37	31	36		137	
8.9	*4.6*	*7.7*	*7.2*		*2.3*	
the	sweet	of	the	year		Verse
11	32	11	15	92		297
11.7	*8.5*	*12.6*	*13.2*	*8.0*		
For	the	red	blood	reigns	Half verse	
22	8	44	29	62	165	
10.3	*2.5*	*4.8*	*5.7*	*7.9*	*3.0*	
in	the	win-	ter's	pale		Verse
13	4	20	41	157		400
15.2	*13.0*	*9.0*	*3.7*	*5.8*		

Table XXVII. presents a mixed type, but too much disturbed by pauses to show the internal structure. Such a rhythm as that in Table XXVIII. is not consistent with any system of proportion between the syllables. As this rhythm does not show definite feet under any construction it remains a puzzle. Similar difficulties appear in Tables XXIX. and XXX., yet those verses were read very rhythmically by the subject. The lines of which the analysis is given in Table XXXI. are supposed to be regularly dactylic. Scanned thus they give fairly uniform feet in rather slow time. Another and freer scansion also gives about the same regularity. The difficulty with the conventional scansion is that it makes the final syllable of several feet very short; a condition which was not found in any of the nonsense rhythms. The cause of the length of the final syllable in all the rhythms seems to be the presence in it of a pause at the end of the foot. The absence of a long syllable, *i. e.*, of the sign of pause, argues that the foot does not really end

TABLE XXVIII

AVERAGES OF 10 READINGS BY H

I	stood	on	the	bridge	at	mid	night	Verse
25	27	27	16	28	17	25	76	241
15.0	*9.4*	*7.5*	*5.8*	*3.9*	*14.0*	*11.0*	*7.3*	

As	the	clocks	were	strik	ing	the hour	Verse
17	17	34	33	32	23	129	285
12.0	*13.0*	*15.0*	*14.0*	*6.5*	*13.0*	*6.7*	

And	the	moon	rose	o'er	the	ci	ty	Verse
18	12	37	34	36	15	18	59	229
13.0	*18.0*	*9.0*	*10.0*	*7.0*	*9.5*	*8.5*	*16.0*	

Be	hind	the	dark	church	tower	Verse
11	39	15	37	44	184	330
10.0	*8.0*	*3.2*	*7.1*	*6.1*	*5.2*	

TABLE XXIX

AVERAGES OF 10 READINGS BY H

Sun	set	and	eve	ning	star	Verse
46	48	20	25	24	105	268
9.8	*8.7*	*8.0*	*12.0*	*13.0*	*7.6*	

And	one	clear	call	for	me	Verse
18	54	48	47	24	91	282
12.0	*8.2*	*5.4*	*4.3*	*8.3*	*4.5*	

And	may	there	be	no	moa	ning	of	the	bar	Verse
20	31	25	19	28	28	19	17	20	64	271
5.4	*13.0*	*5.8*	*11.0*	*5.6*	*7.8*	*8.8*	*15.0*	*3.9*	*16.0*	

When	I	put	out	to	sea	Verse
24	32	15	37	15	180	303
7.9	*8.6*	*11.0*	*8.6*	*8.1*	*4.0*	

TABLE XXX

AVERAGES OF 10 READINGS BY H

The	day	is	done	and	the	dark	ness	Verse
18	24	35	73	20	17	31	47	265
5.1	*6.3*	*8.4*	*5.5*	*8.0*	*4.1*	*4.9*	*7.2*	

Falls	(from the)	wings	(of the)	night	*Pause*	Verse
51	20	50	22	57	138	338
5.7	*8.6*	*5.6*	*12.0*	*5.1*	*6.2*	

TABLE XXXI

AVERAGES OF 10 READINGS BY H

a′	b	c	a′	V	b	V	c	V	a+b+c	V	b+c+a[21]	V	Verse
Know	ye	the	30	*3.0*	30	*6.1*	16	*6.8*	76	*4.5*	59	*3.4*	
land	where	the	43	*10.0*	25	*5.7*	16	*11.0*	83	*7.1*	84	*4.6*	
cy	press	and	32	*8.1*	33	*7.0*	15	*10.0*	80	*3.2*	80	*3.8*	
myr	tle		31	*5.9*	62	*7.5*							333
		Are					17	*10.0*					
em	blems	of	29	*7.3*	31	*6.8*	30	*10.0*	90	*5.4*	77	*4.4*	
deeds	that	are	36	*11.0*	16	*12.0*	30	*8.4*	81	*4.7*	65	*7.3*	
done	in	their	19	*5.3*	19	*5.7*	26	*7.2*	64	*5.0*	64	*5.6*	
clime			207	*7.5*									460

[21] Scanned—Know ye | the land where | the cypress | and myrtle |
Are emblems | of deeds | that are done | in their clime |.

in this syllable. In no case has a verse of poetry been found in triple rhythm with the initial syllable accented and short, the last unaccented and long; and as this is the normal form of the simple spoken dactyl, we have to conclude that none of the verses studied are true dactyls according to this standard. No basis whatever appears for distinguishing dactyls from anapæsts.

(*f*) *Regularity of Feet and Syllables*

Two purposes are served by measuring a large number of nonsense syllables. One to obtain the type form of certain spoken rhythms as regards their true structure independent of the influence of the verbal and ideational content of the verse. The other end, and the one which made imperative the accumulation of a large number of measurements of the same rhythm, was to secure empirical data with regard to the variability of the feet and their constituent parts. The amount which such nonsense syllables vary may be considered as the amount of the variation of enunication when the rhythm is as regular as possible. The variations found in ordinary verse can then be compared with these as a standard and we shall be able to state in what respects the ordinary verse is more irregular than the necessities of verbal utterance in the prescribed rhythm compel.

Theoretically such a determination of a standard of variability should rest upon a very large number of single measurements. But the nature of our material precludes the use of more measurements than can be got from a subject at a single sitting and while his tempo is fairly constant. A change of tempo, of course, affects the homogeneity of the group of figures and thereby produces a very considerable apparent increase in the variability of the series. The number of measurements therefore in a series is determined by the number of repetitions of the verse which could be made by the subject before his rate of reading was appreciably slowed down or accelerated by fatigue or impatience; and the actual number secured depends largely on the original rate of the reader and the length of the verse. Slow reading or long verses yield fewer reliable cases.

Throughout the tables I have taken the variability in terms of the mean variation per cent. of the average value of the quantity. This procedure is open to serious objection,[22] and yet it is the only course which is supported by common sense. To take the absolute amount of the variation affords no way of comparing the variability of one series with that of another; yet that is precisely what we

[22] Thorndike, "Empirical Studies in the Theory of Measurement," p. 9, these *Archives*, No. 3, 1907.

want to do with the variability when we get it. The variation proportional to the amount of the quantity does afford a basis of comparison between quantities and is the figure which is comprehensible and in general use. No other measure of variability is obtained so directly and no other conveys any direct information at all. This measure must be considered the experimental datum and if it misrepresents the facts or leads to inconsistencies it must be corrected

TABLE XXXII

VARIATION OF FOOT AND CONSTITUENT SYLLABLES. Under V the mv. per cent. of the foot. Under $\sqrt{}$ the square root of the sum of the squares of variations of the constituent syllables reduced to per cent.

	1st Foot		2d Foot		3d Foot	
Subject W	V	$\sqrt{}$	V	$\sqrt{}$	V	$\sqrt{}$
Pa pa′	7.1	6.4	7.0	5.9	7.1	6.0
Pa′ pa	4.9	4.7	4.8	4.4	5.4	5.0
Oh pa′ pa	4.5	4.0	5.2	4.2	4.8	4.1
Average	5.5	5.0	5.7	3.8	5.8	5.0
Subject H						
Pa pa′	3.8	3.5	3.8	4.1	3.2	3.5
Pa pa′r	2.9	3.2	2.8	3.0	3.2	3.4
Pa pa′rs	2.1	2.7	2.4	2.7	2.7	2.4
Pa pa′rst	4.3	3.7	2.8	3.1	3.5	3.5
Pa′ pa	4.2	3.8	3.2	3.0	4.4	3.7
Oh pa′ pa	4.2	4.7	3.9	4.6	3.5	4.7
Average	3.6	3.6	3.1	3.4	3.4	3.5
Subject F						
Pa pa′	4.4	4.3	4.9	4.4	6.4	4.9
Pa pa′	4.7	4.9	6.1	5.7	5.2	4.9
Pa pa′r	5.0	5.0	5.5	4.6	4.7	4.6
Pa pa′rs	7.1	7.3	9.1	8.1	7.4	6.7
Pa pa′rst	6.8	6.2	5.8	5.5	6.7	5.8
Pa′ pa	3.8	4.1	4.0	4.4	2.9	3.6
Oh pa′ pa	4.5	5.3	4.7	5.7	5.2	5.4
Average	5.2	5.3	5.7	5.5	5.5	5.1
Subject B						
Pa pa′	3.5	3.8	4.3	3.7	3.5	3.8
Pa pa′	4.8	5.0	4.2	4.0	5.1	5.1
Pa pa′r	3.2	3.9	3.7	3.6	3.0	3.3
Pa pa′rs	4.2	5.1	3.7	4.2	3.4	3.9
Pa pa′rst	6.4	6.1	6.5	6.0	5.5	5.7
Pa′ pa	4.8	4.9	5.4	5.1	5.1	5.4
Oh pa′ pa	4.7	5.6	4.8	6.9	3.5	4.7
Average	4.5	4.9	4.7	4.8	4.2	4.6

subsequently.[23] So measured the variability of short syllables is found, throughout the tables of nonsense verse, almost without exception, greater than that of the corresponding long syllables. The long syllable being terminal in the verse and including a more or less conspicuous "pause" or silence might reasonably be the more irregular but is not. When the short syllable is stressed it does not lose its excess of variability, unless it also gains in duration.

Since speech sounds are essentially movements there is some reason for assuming that they should be subjected to the correction proposed by Fullerton and Cattell,[24] that is, that each variation be divided by the square root of the corresponding quantity. But there is no apparent reason why one syllable should be treated as a multiple of other shorter ones, and I see no reason for obliterating by this procedure a result which may be highly significant. For purposes of comparison the feet may be considered as having, as units, a variation of their own. But considered as made up of syllables each of which may vary independently the feet will be expected to vary as the square root of the sum of the squares of the variations of the constituent syllables. Table XXXII. shows that such is the case within limits set by the number of cases considered. The conclusion then is that the syllables do vary independently and that the feet are really no more regular than the syllables. Whether there is a tendency for the two parts of a disyllabic foot to compensate, the second being longer if the first is shorter and *vice versa* should be determined by the correlation of the two series of elements. But the constant changes in the time of reading the whole line generally occasion such a large apparent positive correlation that the true correlation is covered up. If there were any such tendency toward compensation it would make itself felt in Table XXXII. Subject W does show feet more regular than a chance combination of the syllables would warrant, and there are a few other cases of the same sort. But on the whole as stated above, no marked tendency toward compensation appears.

One series of one hundred verses was taken with the special object of determining the relative variability of the syllables and

[23] I do not believe, however, that such correction is ever necessary. It seems to me that what we *mean* by variability is proportional variation, and if a large quantity, for instance varies less, proportionally than a small one, *it is really less variable.* Apparent inconsistencies arise either from arbitrary classification into genera which are not homogeneous or from arbitrary methods of correlation.

[24] "On the Perception of Small Differences," p. 153, University of Pennsylvania, *Philosophical Series,* No. 2, 1892.

feet, Table XXXIII. This particular reader was able to keep up a very constant rate of reading so that the disturbing correlation due to change of tempo is not prominent. The averages for the first half of the series were almost identical in every case with those of the second half. The variations themselves are small. According to the standard applied in the other cases there must be compensation between the syllables of the foot since its actual variation is less than the square root of the sum of the squares of the variations

TABLE XXXIII

THE VARIATION OF THE FOOT AND OF THE COMPONENT SYLLABLES IN THE 3D FOOT OF THE ANAPESTIC TETRAMETER, *Tadadée*, etc., TOGETHER WITH THE CORRELATION BETWEEN THE SEPARATE SYLLABLES. 100 readings by R.

	ta	da	tada	*tada*[25]	dee	tadadee	*tadadee*[25]
Average time	19	21	40		34	74	
Mean variation (AD)	.96	.96	1.15	*1.35*	1.78	1.98	*2.24*
mv. per cent.	5.1	4.6	2.9	*3.3*	5.2	2.7	*3.0*
Standard (square root) deviation	1.29	1.23	1.60	*1.78*	2.14	2.34	*2.32*

	ta, da	ta, dee	da, dee	tada, dee
Pearson coefficient of correlation	— .21	— .28	+ .03	— .28

of its syllables. This conclusion is supported by the application of the Pearson coefficient of correlation. The first and second, first and third, and the sum of the first two syllables and the third, show a definite inverse correlation. That is, when one is short the other is long. The absence of correlation between the second and third syllables is not important. With regard to the constancy of the ratio of the syllables the other nonsense verses show negative results. There is no sign of positive correlation. But in this favorable case the results are conclusive on this point. The foot is the regular thing and the ratio is sacrificed to preserving its regularity.

For practical purposes of comparison the variability of the ratio between the syllables of a foot is a valuable item; the more constant the internal structure the lower this variability will be. No attempt has been made, however, to compare the variability of the feet in respect to their length with their variability in internal proportion. The length might vary greatly without affecting the ratio. That it does not happen so means that ratio and length are both variable but does not indicate that either is more so than the other. In the verses of poetry the number of cases is not sufficient to warrant exact inferences, but the variability of the foot is less in nearly every case than that of the separate syllables.

[25] The square root of the sum of the squares of the variations of the component parts.

TABLE XXXIV

Averages of 10 Readings by H

And	he	dan	ces,	and	he	yells;				
28	20	31	25	18	23	100				
11.0	*12.0*	*6.9*	*12.0*	*17.0*	*13.0*	*10.0*				
Kee	ping	time,	time,	time,						
19	26	78	79	110						
13.0	*10.0*	*6.3*	*6.2*	*10.0*						
In	a	sort	of	Run	ic	rhyme,				
13	12	29	12	26	21	99				
12.0	*16.0*	*6.5*	*17.0*	*6.3*	*5.4*	*15.0*				
To	the	pæ	an	of	the	bells—				
12	19	18	15	14	19	98				
11.0	*16.0*	*15.0*	*17.0*	*14.0*	*13.0*	*15.0*				
Of	the	bells:								
17	20	125								
14.0	*10.0*	*12.0*								
Kee	ping	time,	time,	time,						
17	26	78	78	109						
14.0	*6.1*	*4.9*	*7.0*	*5.1*						
In	a	sort	of	Run	ic	rhyme,				
12	11	32	14	23	22	98				
18.0	*13.0*	*10.0*	*14.0*	*13.0*	*10.0*	*14.0*				
To	the	throb	bing	of	the	bells—				
12	17	29	18	14	19	133				
7.5	*13.0*	*5.5*	*7.5*	*15.0*	*11.0*	*10.0*				
To	the	tol	ling	of	the	bells,				
12	18	25	17	15	20	103				
16.0	*9.4*	*13.0*	*13.0*	*11.0*	*5.1*	*7.8*				
Of	the	bells,	bells,	bells,	bells,					
16	21	77	79	75	113					
16.0	*11.0*	*7.6*	*4.7*	*3.7*	*4.2*					
Bells,	bells,	bells—								
79	74	112								
7.2	*4.6*	*6.2*								
To	the	moa	ning	and	the	groa	ning	of	the	bells.
13	14	34	17	15	16	31	15	16	18	
10.0	*23.0*	*9.5*	*13.0*	*6.8*	*6.3*	*11.0*	*11.0*	*13.0*	*8.7*	

Iambic rhythm, Table I., is more regular than trochaic with respect to length of foot and syllable for only two of the four readers. The other two read trochaic more regularly in this respect. With respect to ratio neither of these rhythms is more regular than the other. Neither do rising and falling 3-syllable verses, Tables III. and IV., show any differences in stability in time or proportion. The 3-syllable type is as regular in length of foot as the 2-syllable but its separate syllables are more variable. A fair comparison of ratios is not feasible, but if the 3-syllable form be considered as a more complex 2-syllable verse its ratios are very nearly as stable as those of the simpler forms. On the whole all the rhythms attain about the same degree of stability.

The amount of variability in time and ratio shown by the nonsense verse being fairly constant and being based on a fairly large number of observations establishes a norm for spoken rhythms in general. Meaningful verse shows higher variability. This is to be attributed to the greater difficulty of enunciation and to interference from the side of the intellectual content of the line; and, in part, to an increase of the error of reading the record due to its greater complexity.

Syllables, feet and ratios all vary more in poetry than in nonsense verse. The comparison can not be made statistically but a comparison of the variation in Table XV. with those from the same reader, H, in Table I., shows that the excess of the former, item by item, is not great. Such a comparison of any other of the analyzed verses with its corresponding type in the schematic verses will show a similar condition. Poetic verses thus compared with empty spoken rhythms are tolerably regular in every feature. No matter how irregular the verse pattern itself, it is adhered to with great fidelity time after time in repetition, as is seen in Table XXXIV. The structural irregularity of the verse is not therefore a chance affair. If it were, the temporal arrangement would probably be different with each repetition. As the pattern becomes more complex the variability increases but it never exceeds an amount which is surprisingly low if one considers the enormous complexity of the motor performance involved.

In poetic verse there is no evidence that the presence of accent reduces variability, but it is true here as in nonsense verse that short syllables are generally the more variable. The introduction of pauses due to the meaning does not add appreciably to the variability of those syllables with which they are connected.

CHAPTER VII

Significance of Results for Metrical Theory

There are six theories of English verse structure which can be clearly distingiushed.

1. There is the classical or quantitative theory which neglects accent and treats the verse as made up of syllables long and short, the former being theoretically twice as long in time as the latter.

2. The strict time theory, which makes the syllables correspond to notes in music, the feet being treated as measures.

3. The conventional English scansion which makes the rhythm depend on the regular succession of accented and unaccented syllables according to a numerical scheme but without regard to time or quantity.

4. The beat theory of Coleridge which requires a certain number of accents to every line but disregards both the time and the number of syllables intervening between those accents. In this theory the accent may fall on a syllable which is either long or short in time.

5. The "section" or "centroid" system in which an accent is treated as a point of maximum stress in a short phrase.

6. The interval of time between two successive beats is held to be constant and the form of the rhythm is determined by the number of intervening syllables.

1. Without hesitation we can dismiss some of these theories. The measurements of actual verses show nothing corresponding to the long and short syllables of the classical scheme. To be sure, some syllables are long and some short, but there are all gradations between and none of the verses which have been examined shows any systematic arrangement of the longer and shorter elements. Table XXI. illustrates this point no better than many of the others. Here the second line instead of reading as it should according to quantity:

Short, long short short, long short short, long short short, long;
reads

Short, long long long, long short long, short short long, long.

2. The analogy between verse and music has been shown to fail in both its essential features. Highly rhythmical verse if made up of sensible words can not be divided into feet of equal length to correspond to musical measures. And even if these inequalities of

the feet are overlooked in view of the fact that the measures in music itself are not rigidly equal, the analogy still fails for want of any definite element bearing definite relations to other elements within the measure. There is no syllable in verse which takes the place of the standard half or quarter note in music. On the contrary every syllable has its own peculiar time value, and it very frequently occurs that syllables which would be short in the musical plan of the line according to such a scansion as Lanier's are really longer than the theoretically long syllables.

Even in the nonsense syllables every reader must be allowed to have a verse music of his own for not only do different readers have different tempos (which might happen even in music were the latter not highly conventionalized) but each one has his own private ratio between long and short sounds. There is nothing left of the musical analogy if it must be interpreted so freely as to cover all these anomalies.

So much then for the two metrical theories which make time the essential factor in versification. Such relations of duration as they posit are not found in actual verse. The evidence is positive that the regularity of verse does not lie in its time structure. Nevertheless what has been said of the remarkable self-consistency of the complicated verse patterns must not be lost sight of. Time must be more than an incidental feature in rhythm or the repetitions of a verse would differ more from one another in time relations. True as it is that the elements of the verse do not arrange themselves regularly in time yet their arrangement is invariable, and that invariability of the time structure of the rhythm points to the fundamental function of time in the verse rhythm. This argument must, however, take into account the fact that the same verse may have a different rhythmic pattern for different persons.

With the conventional English scansion by number we have nothing directly to do; it must ultimately break down under the logic of its own claim that nothing is right rhythmically but what has the right number of syllables. To say that is to say that some of our best poetry is not good verse. We know that the better the poetry in many cases the better the rhythm of its verse sounds despite its irregularity. Lack of numerical regularity does not destroy the rhythm and the latter can not be grounded on numerical regularity alone.

Of the three remaining theories one calls for a constant number of accents arranged without system in a line; another for an indefinite number of centers of stress. The result is in either case to shift the rhythmic unit from the verse foot to the verse itself. That

there is a rhythm in which the verses are units can not be denied. Its function in poetry is of fundamental importance. But the recognition of this larger rhythm ought not to obscure the existence of rhythm within the verse. Neither of these conceptions of verse make any provision whatever for verse rhythm proper—for that rhythm which we call 2-syllable or 3-syllable, rising or falling.

The sixth and last theory of versification attempts to return to a conception of regularity and supplement the inadequacy of the two last mentioned by reintroducing the factor of time. The conditions of the present set of experiments do not allow of a critical discussion of this point because as has been explained the point of greatest stress could not be recorded. There are, however, certain cases where it is evident that the interval between accents must be far from equal. No matter how much leeway is given to the accent within the stressed syllable of such verses as those in Table XXII., it is not possible to find an arrangement which will leave equal intervals between them. Such cases are, however, rare and there is some reason to believe that if the true points of emphasis could be determined the intervals between them would be found considerably more regular than the conventional feet.

The empirical facts leave no room for a theory of verse rhythm based merely on time. Nor will a close study of the analyzed verses confirm one in a prejudice for any of the formal systems of versification. Here and there there are points in favor of one or another, but none of them are born out in detail. The conclusion must be that a theory of versification which will cover the facts has to begin anew—taking into account all the factors, time, accent, and tone, which can possibly support the rhythmic structure.

Our facts mean simply that time alone will not support the rhythm. There is no reason, however, to suppose that any of the other factors alone can support it. It is a small step in advance to show the inadequacy of partial theories; the more important task remains to find a substitute in the complex which shall take the place of the temporal regularity which, it has been so generally supposed, gave it unity and system.

In any case the starting point must be the rhythm which is actually found in verse. It will not do to suppose with Meumann that the enriching of verse by its content destroys the simple rhythm properly existing there and substitutes for it another—that of the intellect. Such a substitution is preposterous on the face of it. All verse rhythm is felt to be rhythmical—if it is verse at all—and the most beautiful poetic composition no less so than the most nonsensical nursery rime. But if the former rests on an intellectual

or emotional rhythm and the latter on one of sound how do we get from one to the other? Where is the stage when a simple long or loud noise is replaced by a concept of the same weight? Such a substitution will not bear a moment's consideration. Moreover, how does it happen that the sounds themselves even to the most practised ear still sound as rhythmical as ever in the poem after they have lost that pristine regularity which once made of them a rhythm? Worse yet, why is it that we take great delight in repeating the words of a poem in the metrical form even when we pay no attention to the meaning of the verse? And lastly, why do poems lacking in regularity sound rhythmical to us when recited in a foreign language? The truth is that some verse is rhythmical even in cases when it is extremely irregular. Other verse is regular in some respects; and no more nor no less rhythmical. Other speech is fairly regular but possessed of only poor rhythm. Other speech is prose and neither regular nor appreciably rhythmical.

The common man has no difficulty in deciding for himself what is verse and what is prose—what rhythmical and what not. It may depend as Wallin has shown upon how he reads it; under some conditions it may look like prose, when printed differently, like poetry, and his reading will differ accordingly, but his judgment will in either case be correct. When he reads rhythmically he is correct in calling it verse, and if he reads prosily he will call it prose correctly. It does not matter under what suggestion he labors or what impels him to read one way or the other.

There is, of course, a point of indifference. There are things that read so much like prose and so much like verse that no reader can decide. Such cases do not, however, affect the argument. No one has a right to set up a standard which fails to meet the conditions of experience. Nor will it do to deny the existence of an experience which is felt. When verse is read and it feels and sounds rhythmical then it is so, and its deficiencies in the light of some theory or other can not change the fact. So long as the psychological fact of rhythm retains its integrity it is a matter of small weight to the poet and lover of poetry whether its conditions are analyzable out of the objective sound series or whether it is the product of the reader's own activity as he casts the words of the language into a form which suits better his own disposition for temporal regularity and accentual symmetry. But for the psychologist it is worth while to know to what extent sequences of sounds may be objectively irregular and still acquire the rhythmic form.

CHAPTER VIII

Significance of Results for Theory of Rhythm

The fact that music is divided into measures of theoretically equal time value, the fact that we "beat time" at a fairly regular rate and that we frequently resort to rhythmical grouping of sounds in our estimation of time—all these facts and many others have lent color to the popular notion that the two phenomena, time and rhythm, are inseparately connected. It seems to be true that rhythm is only found in a time series—it is a phenomenon of succession or even let us say recurrence—but this is only saying that it is not a matter of spatial arrangement.[1]

Rhythm is a temporal phenomenon; but if active, performed, rhythms are considered it is not obvious that time estimation or a perception of time enters. Nor is there any reason why there should be regularity in time. Such rhythms as the heart beat, walking, tapping, are, however, regular. Breathing is less so. The recitation of nonsense syllables in tetrameter lines is regular as respects the recurrence of beats, the length of the feet and the length of the line. The recitation of simple verses of poetry shows no such regularity. A theory of rhythm based on organic functional rhythms[2] or central nervous rhythms could account for the regularity of certain performed rhythms but there are insurmountable objections to such theories.[3] Explanations of rhythmic perception based on strain of attention or upon expectation and satisfaction tell us nothing of the rhythms which we make as contrasted with those we get. Miner's description of rhythm in terms of concomitant kinæsthetic feelings also fails to take account of that kind of rhythm where the strain and relaxation are original and no concomitant feeling is called for. Meyer[4] recognizes the fact that the direct way to attack this subject is from the side of the reciter or dancer,

[1] There is a certain spatial unity required also, it is true, before we have rhythm; namely, the rhythm must all originate in about the same place. We can not form a rhythmic series one member of which is made by the voice and another by the finger; the rhythm of a clock tick is disturbed by rapid transposition of the whole clock; a pendulum swing fails of its rhythm if its own motion is combined regularly with a motion of translation.

[2] Hallock, *Pop. Science Monthly*, **63**, 425, 1903.

[3] Miner, "Motor Visual and Applied Rhythms," p. 6.

[4] Meyer, *Die neueren Sprache*, **6**, 1899.

not that of the hearer or onlooker. Stetson[5] also recognizes the probable function of direct feelings of tension between opposed muscle sets as the unifying principle in the rhythm group.

If we take the ground that the grouping in rhythm is an affective experience and if we place it simply in the dimension of strain and relaxation it becomes at once clear why no regular time relations are necessary. The regularity becomes a matter of recurrence of strain at the end of a definite cycle. The muscles may take a longer or shorter time to accomplish their cycle and the strain may not come at equal intervals of time but the swing is there and from one place to the next like place is one definite mental state held together by the continuous circular process.

Longer cycles may be made up of a number of smaller ones and as the possible length of any given cycle is undoubtedly controlled within certain physiological limits, it is clear that the time occupied by any five of them, say, will be fairly constant even though the separate cycles vary considerably in duration. The more complex the movement that must be performed in a cycle of any particular form the more the duration of such cycles will vary. The movements of speech are extremely complex and the results show as we should expect a very large difference in the amounts of time occupied by them. The inequality is still further augmented by the mental weighting of the syllables with greater or less meaning according to their logical and grammatical importance. Such weighting seems to increase the strain attaching to the larger or heavier points of the cycle and at the same time complicates the total situation in such a way as to lengthen the time occupied by that cycle in which it occurs.

The movements of singing or tapping on the other hand are comparatively very simple. In singing the single tone is held for the prescribed time and there is none of that shifting stress by which speech is enriched at the expense of euphony. Moreover the stress or strain in music is slight compared to that in verse, the rhythm being comparatively unmarked. In fact, it is often difficult for the untrained ear to discover the rhythmic beats in very good music. Tapping is evidently a succession of very similar movements and that they should take place regularly as regards time is not surprising. And what is here said of tapping applies largely to the performance on musical instruments where the actual movements gone through with are not very different as regards their complexity. There is nothing, therefore, in the temporal regularity of simpler rhythmic processes which contradicts the assumption of a non-temporal theory of rhythm. And the lack of temporal regularity in verse makes such an assumption imperative.

[5] *Psychological Review Mon. Suppl.*, Vol. IV.

Nevertheless the psychologist can not afford to ignore all the good introspection which has reported temporal regularity in verse itself. The facts give the lie to the introspection, but we are bound to discover the source of the latter. If there is an illusion of temporal regularity its cause ought to be known. Some other kind of regularity in the verse might give rise to the illusion. That there is some kind of regularity can not be doubted after considering the fact that intricate verse rhythms can be repeated indefinitely in almost identical form. Other motor performances can not be so accurately reproduced and the words themselves which are employed are not of unvariable duration.[6] The rhythm itself is undoubtedly responsible for this fixity or stability of the verses. But not a time rhythm. If the feeling of rhythm arises out of a series of motor performances of alternate vigor and relaxation the illusion of equality in time would very naturally arise from the apparent equivalence of these series. Objectively they could differ in time very considerably and still be felt as equal on account of the real equality, not of time, but of kind, between the elements.

Two experiences may be physiologically equal so as to accomplish the same result without occupying the same time. But as experiences and transpiring in time there will be a tendency to attribute equal duration to them. That an equality of duration in some sense is generally attributed to the elements of a rhythm is common knowledge. Now we know that, in the case of verse rhythm at least, the equality is not there. Is it not natural then, to conclude that time equality is an inference derived from the apparent equality of two impressions or expressions and confirmed by actual equalities in many rhythms, but not really a constitutive factor in the rhythm at all? After all, time is a very uncertain thing in our experience. Experience itself often does not measure up with the markings on the clock's dial. One hour is long, another short, one second only half as long to us as the next. In the end it will be much simpler to talk of a rhythm which is actually present, perceived or performed, together with and inseparable from its peculiar feelings, the beats of which are not fixed in time, while its effect upon us is that of a series of equal time intervals.

Time not only fails to account for the regularity of verse rhythm; it also fails to offer a base of distinction between the different types of rhythm. Temporally anapæsts are just like dactyls and neither clearly distinguished from iambs. Here the concept of number comes to the rescue only to be followed by unwelcome consequences, and the most satisfactory course is to fall back upon the swing of

[6] Compare, for instance, the lengths of the familiar words "the" or "and" in different verses.

the rhythm itself. The different rhythms form distinct kinds of cycles. It is the perseverance of one of these types throughout a verse or stanza that establishes the rhythm. Each beat, or each swing, brings up another of the same general structure and the same total affective value. Their form depends in part upon the number and character of the syllables, but it also depends very largely upon the disposition of the individual. When one starts to read dactylic verse he finds dactyls provided the syllables can possibly fit that rhythm. He speaks so as to make the segments of equal weight. The rise and fall of his effort is regular and of the peculiar form of that rhythm. The regularity of the motor performance and the equivalence of the resulting feelings leads naturally to the introduction of the impression of temporal regularity; but that impression is really subsequent to the rhythm itself.

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